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PHYSICS AND MATHEMATICS

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UDC 534.88

RECONSTRUCTION OF VERTICAL SOUND VELOCITY PROFILES IN OCEAN FROM ACOUSTIC WAVE REFRACTION

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 30, No 3, May-Jun 84
(manuscript received 7 Jun 82) pp 352-357

OSTASHEV, V. Ye., Institute of Atmospheric Physics, USSR Academy of Sciences

[Abstract] A remote method for reconstructing the vertical profile of the velocity of sound in the ocean is proposed, in which an acoustic source placed near the surface emits an acoustic wave at a slight angle to the surface of the ocean. If the profile at some depth is the same as that on the ocean surface, the wave may reach the surface due to refraction, where it will be scattered on the rough ocean surface. Some of the scattered waves may reach a receiver colocated with the source, in which case the measured quantity will be the time elapsed between the emission and reception of scattered signal. The profile can then be reconstructed in accordance with the relationship between the elapsed time and the angle at which the wave is emitted. References 5: 4 Russian, 1 Western.
[382-6900]

UDC 534.232:666.11

TRANSMISSION OF ULTRASONIC WAVE THROUGH GLASS WITH REGULAR VARIATIONS OF ACOUSTIC PROPERTIES

Leningrad FIZIKA I KHIMIYA STEKLA in Russian Vol 9, No 6, Nov-Dec 83 (manuscript received 18 Nov 82) pp 730-732

LIVSHITS, V. Ya., ABRAMOVICH, A. A. and TENNISON, D. G., Leningrad Technological Institute of the Cellulose-Paper Industry, Higher Technical Training Plant, Leningrad Metal Plant Turbine Building Production Association

[Abstract] The transmission of ultrasonic waves through glass cylinders with flat ends in which the elastic properties are distributed axisymmetrically is investigated. The profile of the variation of the elastic properties is made continuous in the cylinders employed such that the ultrasonic wave velocity increases continuously from the axis to the surface. The acoustic properties change due to the regular and continuous change in the chemical composition of the glass. Gradient acoustic lenses can be employed in ultrasonic flaw detection, medical diagnosis and acoustic holography. Figures 2, references 5 Russian.
[373-6900]

UDC 535.42:538.56:534.2

ACOUSTOOPTICAL INTERACTION OF SURFACE WAVES IN WAVEGUIDE STRUCTURES

Gorkiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian Vol 27, No 5, May 84 (manuscript received 10 May 83) pp 655-660

PETRUN'KIN, V. Yu., VODOVATOV, I. A. and LIPOVSKIY, A. A., Leningrad Polytechnical Institute

[Abstract] Acoustooptical interaction of waveguide structures is examined on the basis of a method for studying light diffraction by ultrasound based on solving an integral equation obtained by introducing equivalent currents in the acoustooptical interaction space. Formulas suitable for numerical calculations are presented. The approach can be used to analyze the diffraction of surface light waves by surface acoustic waves with allowance for nonlinearity of the acoustooptical interaction. Although conversion of channeled light waves to a body wave is disregarded in this paper, the effect can be accounted for in the proposed method, which was not possible in a previously considered method of associated waves. Figure 1, references 5 Russian.
[369-6900]

SURFACE ACOUSTIC SHEAR WAVES AT BOUNDARY OF ELASTIC BODY AND VISCOUS LIQUID (GAS)

Leningrad PIS'MA V ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 10, No 5, 12 Mar 84 (manuscript received 28 Nov 83) pp 296-300

PLESSKIY, V. P. and TEN, Yu. A., Institute of Electrical Engineering and Electronics, USSR Academy of Sciences

[Abstract] The influence of viscous surface loading of an acoustic conductor on shear wave propagation is investigated for a piezoelectric crystal with hexagonal axis parallel to the OZ axis. Shear waves in the piezoelectric and liquid with shifting along the OZ axis propagating in the direction of the OX axis are examined. The surface of an elastic body not demonstrating the piezoeffect is shown capable of sustaining a shear surface wave due to viscous loading. A formula is derived for the depth of penetration of oscillations into the solid body in such a wave. When the surface is loaded with viscous liquid, the wave becomes a surface wave and the oscillations penetrate only a few wavelengths into the acoustic conductor. A formula is derived for the attenuation of the amplitude of Gulyayev-Bleustein waves due to viscous loading; attenuation in strong piezoelectrics due to air loading is found to be significant and only slightly smaller than the attenuation of Rayleigh waves. References 5: 3 Russian, 2 Western.
[384-6900]

SHIFTING OF BUNDLE OF SURFACE ACOUSTIC WAVES DURING REFLECTION FROM PERIODIC STRUCTURE

Leningrad PIS'MA V ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 10, No 10, 26 May 84 (manuscript received 10 Feb 84) pp 613-616

ALYAKNA, Yu. Yu., GULYAYEV, Yu. V., KOTELYANSKIY, I. M., MIRGRORODSKAYA, Ye. N., MISHKINIS, R. A. and PLESSKIY, V. P., Institute of Electrical Engineering Electronics, USSR Academy of Sciences

[Abstract] Substantial shifting of a bundle of surface acoustic waves during reflection due to the distributed nature of wave reflection by the gratings in the aperture is demonstrated. The amount of shift is found to be inversely proportional to the depth of the grating. The reflected beam profiles for different grating depths on an isotropic substrate are analyzed and investigated experimentally. The experimental reflected beam amplitude distributions agree well with the analytical findings. The shifting effect must be taken into account when designing various surface acoustic wave devices in order to reduce mutual losses. Figures 2, references 2 Russian.
[402-6900]

UDC 534.222

SPONTANEOUS AMPLIFICATION OF PARAMETRIC INTERACTION OF ACOUSTIC WAVES IN WATER CONTAINING DISSOLVED GAS

Leningrad VESTNIK LENINGRADSKOGO UNIVERSITETA: FIZIKA, KHIMIYA in Russian Vol 10, No 2, May 84 (manuscript received 11 Oct 83) pp 113-114

VLADIMIROV, Yu. M., DRUZHININ, G. A., MIKHAYLOV, A. A. and TOKMAN, A. S.

[Abstract] The properties of nonlinear interaction of waves in a liquid containing gas bubbles produced by perturbing the medium with pumping waves from a parametric radiator are investigated experimentally. The gas bubbles increased the nonlinearity of the medium, leading to spontaneous amplification of the parametric interaction. Spontaneous amplification of parametric radiation is detected in a 10 x 6 x 6 meter tank filled with fresh tap water containing dissolved gas. The pumping source was a flat piezoelectric radiator 108 mm in diameter with a center frequency of 262 KHz and amplitude of 10^5 Pa. Control experiments conducted in a tank filled with water that had stood for several months revealed no amplification of the difference-frequency waves. References 4 Russian.
[359-6900]

UDC 534.222.2

EXPERIMENTAL INVESTIGATION OF ACOUSTIC BEAMS OF FINITE AMPLITUDE

Moscow VESTNIK MOSKOVSKOGO UNIVERSITETA: SERIYA 3, FIZIKA, ASTRONOMIYA in Russian Vol 25, No 3, May-Jun 84 (manuscript received 6 Oct 83) pp 35-38

ANDREYEV, V. G., KARABUTOV, A. A. and RUDENKO, O. V.

[Abstract] The behavior of diffracted acoustic beams of finite amplitude in free space is investigated experimentally; the results are compared by computer. Conditions are identified that prevent the occurrence of phase shifts between harmonics due to such factors as geometric dispersion, gas vapor bubbles in water, etc. The experiments were conducted in a 2 x 0.75 x 0.75 meter tank filled with standing tap water at 21-22°C. The ultrasound source was a piezoceramic disk 30 mm in diameter with 1 MHz resonant frequency. The distribution of the pressure amplitude on the radiator is shown to have clearly defined edges found to be nearly uniform. The experimental data are found to agree with existing numerical calculations. References 5: 3 Russian, 2 Western.
[360-6900]

LASER EXCITATION OF COUPLED SURFACE ELECTROMAGNETIC AND ACOUSTIC WAVES AND OF STATIC SURFACE STRUCTURES IN SOLIDS

Moscow ZHURNAL EKSPERIMENTAL'NOY I TEORETICHESKOY FIZIKI in Russian Vol 86, No 3, Mar 84 (manuscript received 5 Jul 83) pp 1026-1036

YEMEL'YANOV, V. I. and SEMINOGOV, V. N., Moscow State University imeni M. V. Lomonosov

[Abstract] The theory of stimulated excitation of surface acoustic waves through interaction of laser radiation andaan absorbing solid body is extended to include formation of surface lattices, reversible and irreversible depending on whether or not the process occurs within the range of Hooke's law, with attendant excitation of surface electromagnetic waves over a space-time modulated surface relief. Generation of a surface temperature wave during interference of a surface electromagnetic wave and a pumping radiation wave is followed by excitation of coherent surface acoustic waves and formation of static lattices, the instability of surface acoustic waves being interpreted from the standpoint of such a mechanism. An evaluation of the dependence of the parameters of surface acoustic waves on the parameters of the pumping wave, in the approximation of negligible ponderomotive forces at the body surface and in the linear approximation with respect to the slowly varying amplitude of surface relief modulation, reveals that the behavior of stimulated surface acoustic waves is determined by the incidence angle and the polarization of the pumping wave. The frequency characteristic, depending on the relation between the surface acoustic wave vector and the tangential-component of the pumping wave vector, is different for s-polarized and p-polarized pumping radiation, with either one or two resonant mutual orientations of the two vectors possible in each case. The dispersion equation for surface acoustic waves describes, accordingly not only the Rayleigh kind but also a quasi-static stimulated pumping-dependent kind of such waves. The authors thank S. A. Akhmanov and N. I. Koroteyev for discussions and critical comments. Figures 4, references 18: 10 Russian, 8 Western.
[318-2415]

UDC 621.315.592

ELECTROMODULATION EFFECT IN SCATTERING OF LIGHT IN HETEROGENEOUS TRANSITION LAYER ON METAL-SEMICONDUCTOR BOUNDARY

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 18, No 4, Apr 84 (manuscript received 1 Nov 83) pp 685-690

GOROBEY, N. N., IPATOVA, I. P. and SUBASHIYEV, A. V., Physical-Technical Institute imeni A. F. Ioffe, USSR Academy of Sciences

[Abstract] The influence of an external constant electrical field on the integral intensity of Raman scattering of light in the transitional layer created at a metal-semiconductor boundary is examined, in an n-type metal-semiconductor junction. The electrons transferred due to equalization of the chemical potentials of the contacting media from the metal to the semiconductor create a transitional layer with a regular distribution of free electrons (space charge region). It is found that enhancement occurs for certain dielectric properties of the contact media, and the gain can be as high as 10^3. The enhancement effect is interpreted as resulting from an increase in the normal component of the electromagnetic wave field intensity in the region where the real part of permittivity vanishes. The Raman scattering enhancement phenomenon can be used to identify small concentrations of impurities at the interface between two media. If the dielectric properties of the media are selected so that permittivity vanishes near the boundary, the electrical field of the incident light wave will be amplified in that region. Absorption of light and scattering of light by local modes of impurity atoms are enhanced accordingly. Figures 2, references 10: 3 Russian, 7 Western.
[322-6900]

UDC 621.315.592

ANALYSIS OF ELECTRON SCATTERING MECHANISMS IN GALLIUM ARSENIDE

Leningrad FIZIKA I TEKHNIKA POLUPROVODNIKOV in Russian Vol 18, No 5, May 84 (manuscript received 26 Oct 83) pp 946-949

FROLOV, I. A., AVER'YANOV, V. Ye., and KRUPKIN, P. L., Gorkiy State Pedagogical Institute imeni M.NN. Gor'kiy

[Abstract] An approach to determining the quality of semiconductor materials is formulated on the basis of formalizing quality criteria by analyzing electron scattering mechanisms in gallium arsenide. The spectral characteristics are calculated on the basis of orthogonal expansions in Hilbert space. A formula is derived for the temperature behavior of electron mobility restricted by scattering on ions and dipoles. The results of spectral analysis of charge carrier mobility in epitaxial layers of gallium arsenide are presented. The proposed method can be used to calculate the mobility and field dependence of the electron velocity, as well as to find the voltage-current characteristics and impedance of the medium for any external conditions. Spectral representation of semiconductor parameters is more suitable for machine processing of results. Figure 1, references 6 Russian. [368-6900]

UDC 535.241.13:534

ACOUSTOOPTICAL DEFLECTOR USING PARATELLURITE CRYSTAL

Tashkent IZVESTIYA AKADEMII NAUK UZBEKSKOY SSR: SERIYA TEKHNICHESKIKH NAUK in Russian No 2, Mar-Apr 84 (manuscript received 12 Nov 82) pp 62-65

AZAMATOV, Z. T., BELIKOV, I. B., BOLOSHANOV, V. B., DERYUGIN, I. A., MAMATDZHANOV, F. D. and PARYGIN, V. N., Uzbek Scientific-Industrial Association 'Kibernetika', UzSSR Academy of Sciences

[Abstract] A paratellurite crystal is an efficient acoustooptical device, requiring only a small electric control signal and, therefore, being very suitable as a deflector of laser beams - despite its acoustic anisotropy and optical activity combined with appreciable absorption of ultrasonic microwaves. An experimental study of such a deflector was made using a 5 x 7.5 x 10 mm TeO_2 crystal and laser radiation at the λ = 633 nm wavelength. An acoustic shear wave in the [110] direction was excited by an X-cut $LiNbO_3$ piezoelectric transducer. Its facets were polished to a class 14 finish. The velocity of ultrasonic waves at f = 30-60 MHz frequencies, determine from readings of the diffraction angle, was $6.17 \cdot 10^4 \pm 1\%$ cm/s. Probing of the acoustic column with a laser beam revealed a sound beam of intricate structure with a two-peak power-frequency characteristic. Elliptically polarized light was made to impinge on the deflector cell at the Bragg angle, the laser beam with a radius of 0.15 cm passing under the transducer,

with the signal power regulated so as not to exceed a diffraction efficiency of 20% and thus remain within the linear range of its dependence on the signal power. The frequency dependence of the deflector's diffraction efficiency was measured with the light beam passing through a quarter-wavelength plate before impinging on the acoustic wavefront at an angle (0.156 rad) corresponding to the center frequency of the scan band (37 MHz). The dependence of the deflector's diffraction efficiency, in both first and second diffraction orders, on the transducer voltage was determined along with the maximum attainable diffraction efficiency and the corresponding voltage. Scattering of light from first to second diffraction order was found to limit the diffraction efficiency in the first order to levels not higher than 50%. A diffraction efficiency of 72% in the second order was attained with a 100-150 mW electric control signal and a transducer voltage not exceeding 1.8 V, the maximum number of resolvable elements in the deflector reaching N = 280 and the deflector response speed reaching τ = 16 μs at the λ = 633 nm wavelength. Figures 4, references 5 Russian.
[317-2415]

UDC 535.343.2

INTER-BAND OPTICAL ABSORPTION IN SEMICONDUCTORS WITH MICROCRYSTALLINE STRUCTURE

Tomsk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: FIZIKA in Russian Vol 27, No 5, Mar 84 (manuscript received 18 May 83) pp 43-50

ISKRA, V. D., Ukrainian Agricultural Academy

[Abstract] A simple model of a semiconductor with microcrystal structure is examined. The model is used to investigate the intrinsic random field and to determine the frequency behavior of the coefficient of absorption of light in the region of the optical tail caused by the intrinsic random field of an unordered semiconductor, which is determined by the nature of that field which, in turn, depends upon the type of binary correlation function representing the average of the product of the fluctuations of the potential of the electron energy at two different points in space. Figures 3, references 23: 9 Russian, 14 Western.
[348-6900]

UDC 533.34:548.0

ESTIMATION OF MINIMUM POSSIBLE OPTICAL LOSSES IN THALLIUM HALIDE CRYSTALS

Leningrad OPTIKA I SPEKTROSKOPIYA in Russian Vol 56, No 3, Mar 84 (manuscript received 2 Jun 82) pp 457-460

DIANOV, Ye. M., LISITSKIY, N. S., PLOTNICHENKO, N. S., SULIMOV, V. B. and SYSOYEV, V. K.

[Abstract] The minimum possible (intrinsic) optical losses in KRS-6 and KRS-5 thallium halide crystals are estimated. Expressions are derived for the electron and phonon absorption, as well as Brillouin scattering in the high transparency region. It is found that these crystals have minimum optical losses at wavelengths of 7.94 μm and 12.94 μm. The material dispersion disappears at 5.05 μm for KRS-6 and 6.62 μm for KRS-5. Figures 2, references 15: 8 Russian, 7 Western.
[389-6900]

UDC 533.32:548.0

INVESTIGATION OF TEMPERATURE BEHAVIOR OF INDEX OF REFRACTION OF SAPPHIRE

Leningrad OPTIKA I SPEKTROSKOPIYA in Russian Vol 56, No 3, Mar 84 (manuscript received 23 Jun 82) pp 461-463

BUKATYY, V. I., GONCHAROV, Yu. V., KRASNOPEVTSEV, V. N., SHAYDUK, A. M., LUSHEV, V. P., PAVLENKO, A. A. and POTAPOV, M. G.

[Abstract] The temperature behavior of the index of refraction of a leucosapphire crystal is investigated over the 20-1000°C temperature interval at wavelengths of 546.1 and 579.1 nm. A setup based on an ITR-1 interferometer modified to determine the temperature behavior of the index of refraction of solid transparent substances is described. The index of refraction is found to be a near-linear function of temperature for both wavelengths. Figures 3, references 6: 1 Russian, 5 Western.
[389-6900]

GLOWING OF METAL SURFACE EXCITED BY LASER PULSES WITH DIFFERENT DURATION

Leningrad PIS'MA V ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 10, No 11, 12 Jun 84 (manuscript received 24 Apr 84 after revision) pp 689-692

BEN'KOV, A. V., ZINOV'YEV, A. V. and USMANOV, T., Institute of Electronics imeni U. A. Arifov, Uzbek SSR Academy of Sciences

[Abstract] Two types of metal surface glowing (nonequilibrium electromagnetic radiation and thermal radiation) as the duration and intensity of laser radiation is varied are reported. In the experiment a single crystal of tungsten was placed in the beam of a ruby laser in the quasicontinuous and Q-switched modes. The glow intensity of the target was found to be associated with the laser radiation power. The findings indicate the occurrence of nonequilibrium processes and call into doubt the possibility of using optical pyrometry during laser irradiation in the nanosecond pulse range. Since the intensity of nonequilibrium electromagnetic radiation can far exceed the intensity of thermal radiation, allowance must be made for the former in the energy balance in irradiating metals with powerful laser radiation. Figure 1, references 4: 3 Russian, 1 Western.
[390-6900]

COHERENT AMPLIFICATION OF ULTRASHORT PULSES IN ACTIVATED CRYSTALS

Moscow ZHURNAL EKSPERIMENTAL'NOY I TEORETICHESKOY FIZIKI in Russian Vol 86, No 4, Apr 84 (manuscript received 18 Aug 83) pp 1227-1239

VARNAVSKIY, O. P., KIRKIN, A. N., LEONTOVICH, A. M., MALIKOV, R. F., MOZHAROVSKIY, A. M. and TRIFONOV, Ye. D., Institute of Physics imeni P. N. Lebedev, USSR Academy of Sciences

[Abstract] Coherent amplification of ultrashort pulses in Nd:YAG and ruby<Cr>crystals at approximately 100 K is analyzed in the semiclassical approximation for a nondegenerate two-level system. Pulses in the picosecond range are considered of duration shorter than the characteristic time of transverse relaxation in the medium. The corresponding Maxwell-Bloch equations for the electric field and the atom density matrix are solved in the approximation of unidirectional plane transverse waves and slowly varying amplitude. An evaluation in terms of the McCall-Hahn area theorem yields the pulseform evolution during propagation through an amplifying medium, in contrast to the behavior in an attenuating one. Calculations based on slow transverse relaxation and negligible volume losses reveal that, unlike in the case of noncoherent amplification, there appears a doublet structure in the emission spectrum and the field envelope oscillates with sign reversal at the trailing edge of the pulse. The theoretical results are corroborated by experimental data. Bar crystals of YAG + 1% Nd (dimensions 5 x 60 mm), of YAG + 0.6% Nd (dimensions 8 x 80 mm), and of ruby containing $1.5 \cdot 10^{19}$ cm^{-3} Cr atoms (dimensons 12 x 120 mm) were pumped with radiation from IFP flash

lamps. The time and phse parameters characterizing the pulseform and the emission spectrum were measured with a 20 ps resolution in an electron-optical chamber. The shortness of amplifiable pulses was found not to be limited by the line width, inasmuch as pulses of duration shorter than the reciprocal of the line width could be coherently amplified. The authors thank M. D. Galanin for interest and attention, and A. V. Larikov, R. G. Mirzoyan, I. R. Satayev for assistance with the experiments.
Figures 10, references 39: 20 Russian, 19 Western.
[337-2415]

ELECTRICITY AND MAGNETISM

ARTIFICIAL DEFOCUSING LENS IN IONOSPHERE

Moscow PIS'MA V ZHURNAL EKSPERIMENTAL'NOY I TEORETICHESKOY FIZIKI in Russi
Vol 39, No 11, 10 Jun 84 (manuscript received 24 Jan 84, after revision, 8 May 84) pp 533-536

BOYKO, G. N., VAS'KOV, V. V., GOLYAN, S. F., GUREVICH, A. V., DIMANT, Ya. ., ZYUZIN, V. A., KIM, V. Yu., KOMRAKOV, G. P., LOBACHEVSKIY, L. A., MIGULIN, V. V., MITYAKOV, N. A., PANCHENKO, V. A., POLIMATIDI, V. P. and RYZHOV, V. A., Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation, USSR Academy of Sciences, Scientific-Research Radio Physical Institute

[Abstract] Strong defocusing of perturbing radio waves is detected, indic :- ing the creation of an effective defocusing lens in the ionosphere. Modes in which there is no anomalous absorption are employed in order to isolate the defocusing effects unambiguously. The experimental setup incorporates a 300 MW "SURG" heating system with a narrow radiation pattern. The concentration perturbations are diagnosed in the vertical sounding mode at 8 frequencies by means of a Doppler system. The experimental results were obtained during May and July 1983 under daytime conditions. The amplitude and Doppler frequency shift behavior of the probe wave is analyzed, and th defocusing coefficient is computed as a function of the frequency of the probe wave and power of the heating wave. The artificial lens detected results in significant attenuation of radio waves passing through it. References 6: 5 Russian, 1 Western.
[372-6900]

UDC 533.6.011.72

SPHERICAL EXPLOSION WITH INTENSE RADIATION IN BOUNDED GAS CLOUD

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 276, No 4, Jun 84
(manuscript received 21 Jul 83) pp 858-861

NEMCHIKOV, I. V., TRUBETSKAYA, I. A. and SHUVALOV, V. V., Institute of Terrestrial Physics imeni O. Ye. Shmidt, USSR Academy of Sciences

[Abstract] A point explosion with a very strongly luminescent shock wave and infinite compression behind the front is examined. The model constructed for the process is tested by applying it to a radiation gas dynamic problem employing xenon as the working gas. The radiation flux is found to be near-hydrodynamic. The estimates and calculations show that more than 50% of the initial energy can radiate during an explosion in a bounded gas cloud, with the radiant flux determined mainly by the flux of hydrodynamic energy. References 6 Russian.
[361-6900]

TURBULENT COMBUSTION OF GAS IN UNSEALED VESSEL

Novosibirsk FIZIKA GORENIYA I VZRYVA in Russian Vol 20, No 2, Mar-Apr 84
(manuscript received 18 Nov 82; revised 22 Feb 83) pp 28-33

MOL'KOV, V. V., NEKRASOV, V. P., BARATOV, A. N. and LESNYAK, S. A.

[Abstract] Turbulent combustion of a gas in a vessel is investigated for a number of conditions in which the vessel loses its integrity. The experiments were conducted in a vessel with a relief opening 50 mm in diameter communicating through a 50-mm pipe 1.83 or 2.35 m long with a 50 dm^3 receiving vessel. Analysis of combustion indicates that the pipe and the receiving vessel have a strong influence on the dynamics of the development of the explosion of gas-vapor-air mixtures in the primary vessel when the seal is ruptured. The combustion process in the vessel accelerates mainly due to strong burning of the fresh mixture that passes into the pipe. If the escape of this mixture is prevented, for example by using a water curtain in the pipe, the turbulization can be reduced almost to the level of a mixture escaping into the atmosphere. References 9: 7 Russian, 2 Western.
[304-6900]

INVESTIGATION OF MECHANISM UNDERLYING TRANSMISSION OF GAS DETONATION THROUGH LIQUID FILM

Novosibirsk FIZIKA GORENIYA I VZRYVA in Russian Vol 20, No 2, Mar-Apr 84 (manuscript received 4 Jan 83) pp 107-114

SUBBOTIN, V. A. and USOL'TSEV, S. P.

[Abstract] The transmission of gas detonation through a liquid film is examined by photographing the propagation of the detonation through explosive-filled cells formed by a soap film held by a wire framework, The existence of a jet mechanism underlying the transmission of detonation from cell to cell is confirmed experimentally. It is found that a shock wave forms behind the liquid film after the film is struck by the detonation wave; detonation recovers behind the film due to combustion of the gas on the turbulent contact surface and the subsequent transmission of combustion to detonation. The influence of the liquid barriers on the average detonation velocity is found to be small due to the jet mechanism underlying the transmission of combustion from cell to cell. References 10: 5 Russian, 5 Western.
[304-6900]

DIFFUSION COMBUSTION OF LIQUID FUEL IN FLOW WITH DISTRIBUTED PARAMETERS

Novosibirsk FIZIKA GORENIYA I VZRYVA in Russian Vol 20, No 3, May-Jun 84 (manuscript received 22 Apr 83) pp 26-35

SMIRNOV, N. N.

[Abstract] A scheme is proposed for investigating laminar diffusion of falmes over a liquid fuel in a stream of oxidant or behind a shock wave. The principles of diffusion combustion of heterogeneous systems are studied: the mass exchange, friction and heat flow in the fuel layer are investigated. The distribution of the parameters (temperature, concentration, etc.) in the boundary layer, and the influence of heat- and mass-exchange on these distributions, are studied. Figures 3, references 12: 7 Russian, 5 Western.
[405-6900]

MECHANISMS OF VARIATION IN LENGTH OF DIFFUSION FLAMES OF GASEOUS FUELS IN ACCOMPANYING AIR STREAM

Novosibirsk FIZIKA GORENIYA I VZRYVA in Russian Vol 20, No 3, May-Jun 84 (manuscript received 14 Jan 83) pp 46-51

ANNISHKIN, Yu. M. and SVERDLOV, Ye. D.

[Abstract] The influence of the relative area of the edges of the fuel nozzles on variation in the flame length in the accompanying stream of oxidant is investigated experimentally. The conditions that facilitate reliable propagation of the flame for all of the jets of fuel exiting a frontal device are identified. It is found that when a diffusion flame is stabilized on the wide edges of fuel nozzles the relative area of the edges has a strong influence on the mixing and diffusion combustion. Mixing intensifies, and the flame becomes smaller, as the edge area and relative velocity of the accompanying stream increase. The findings are valid for single flames or groups of flames. Figures 6, references 10: 8 Russian, 2 Western.
[405-6900]

DETERMINING EFFICIENCY OF EXPLOSIVES

Novosibirsk FIZIKA GORENIYA I VZRYVA in Russian Vol 20, No 3, May-Jun 84 (manuscript received 29 Apr 83) pp 60-63

SHVEDOV, K. K.

[Abstract] A method is proposed for estimating the portion of work of an explosion that is associated with expansion of the detonation products. An expression is derived for computing the real expansion work numerically based on the known detonation parameters and equation of state of the detonation products. Numerical calculations show that a full characterization of the relative effectiveness of an explosive requires that the pressure, mass velocity and polytropic index of the detonation products be known, which then allows the expansion work to be computed. The connections revealed between efficiency and detonation characteristics make it possible to assess the effectiveness of various explosions more quickly and to consolidate explosive product lists and testing methods. Figures 3, references 10 Russian.
[405-6900]

ELECTROMAGNETIC MEASUREMENTS OF MASS VELOCITY BEHIND DETONATION FRONT IN GASES

Novosibirsk FIZIKA GORENIYA I VZRYVA in Russian Vol 20, No 3, May-Jun 84 (manuscript received 14 Jan 83) pp 74-79

PINAYEV, A. V. and SYCHEV, A. I.

[Abstract] A new electromagnetic method is proposed for measuring the velocity of the conducting medium. The possibility of measuring the mass velocity profiles in detonation waves employing electrode geometries and electrical (radial) and magnetic (eddy) fields as described in a separate study by the principal author is demonstrated experimentally. The necessary conditions for simultaneous measurement of the mass velocity and electrical conductivity are discussed; mass velocity measurements are made, and the computed velocity profiles are compared with those measured by the electromagnetic method and the spontaneous luminescence track method. The velocity profiles found by the track method and the proposed electromagnetic method agree satisfactorily, and are smaller than the calculated values. Figures 6, references 19: 12 Russian, 7 Western.
[405-6900]

UDC 536.423.1

INFLUENCE OF MAGNETIC FIELD ON CONTACT WETTING ANGLE DURING RAPID BOILING

Minsk INZHENERNO-FIZICHESKIY ZHURNAL in Russian Vol 46, No 5, May 84 (manuscript received 14 Jan 83) pp 720-723

CHIGAREV, N. B., Stavropol State Pedagogical Institute

[Abstract] The influence of an applied magnetic field on the contact angle of wetting is determined; the relative changes in the average diameter of separating bubbles and contact angle by such a field are assessed. An interpretation is given of the mechanism underlying the interaction of a magnetic field and the microparameters of boiling in the model of a bubble with a microscopic layer. The experiments indicate that the magnetic field caused the diameter of the vapor bubbles to reduce in proportion to the contact angle. Most of the molecules are found to become oriented when the field is engaged, which has a strong influence on the microparameters. Some of the remaining molecules can then also become oriented as the field intensity increases, which explains the reduction in the influence of the field. Figure 1, references 11 Russian.
[333-6900]

UDC 532.516

ANGULAR OSCILLATIONS OF ELLIPSOID OF REVOLUTION IN BOUNDED VOLUME OF VISCOUS LIQUID

Moscow IZVESTIYA AKADEMII NAUK SSSR: MEKHANIKA ZHIDKOSTI I GAZA in Russian
No 2, Mar-Apr 84 (manuscript received 3 Jan 83) pp 34-39

MIKISHEV, G. N. and STOLBETSOV, V. I.

[Abstract] Small angular oscillations in an ellipsoid of revolution in a cylinder with flat ends are examined. The problem of determining the hydrodynamic coefficients during oscillations in an ellipsoid in a space bounded by a cylinder is considered. The theoretical findings are checked by determining the hydrodynamic coefficients for an elongated ellipsoid of revolution oscillating with respect to the minor axis in cylindrical water-filled tanks. The experimental and calculated hydrodynamic coefficients are found to agree well. Figures 3, references 9: 7 Russian, 2 Western.
[321-6900]

UDC 532.526.2/4:536.24

FRICTION AND HEAT EXCHANGE IN LAMINAR AND TURBULENT BOUNDARY LAYERS WITH AXISYMMETRICAL BODIES EXPOSED TO HETEROGENEOUS SUPERSONIC FLOW

Moscow IZVESTIYA AKADEMII NAUK SSSR: MEKHANIKA ZHIDKOSTI I GAZA in Russian
No 2, Mar-Apr 84 (manuscript received 3 Jan 83) pp 65-72

YEREMEYTSEV, I. G. and PILYUGIN, N. N.

[Abstract] Generalized formulas are derived for heat flow and friction stresses of the laminar and turbulent flow modes in a boundary layer for uniform and nonuniform flow about a body. An axisymmetrical blunt body is placed in a supersonic flow field of heated gas. The quasiunidimensional problem of the flow of a chemically nonequilibrium nonviscous gas is solved numerically in the region between the supersonic source and the shock wave. The flow of a nonuniform stream of gas about a spherically blunted body is analyzed as an example. Approximate expressions are derived for the distribution of the local heat flow and friction stress along the spherical surface of the body. The principles established are easily detected experimentally by measuring the integral coefficients of heat exchange, friction resistance and wave drag for bodies placed in nonuniform gas flows. Figures 5, references 15: 13 Russian, 2 Western.
[321-6900]

UDC 533.6.011

HYSTERESIS OF SUPERSONIC SEPARATED FLOWS

Moscow IZVESTIYA AKADEMII NAUK SSSR: MEKHANIKA ZHIDKOSTI I GAZA in Russian
No 2, Mar-Apr 84 (manuscript received 17 Jan 83) pp 116-125

GUZHAVIN, A. I. and KOROBOV, Ya. P.

[Abstract] The nature and conditions for occurrence of hysteresis of supersonic separated flows are analyzed on the basis of experiments performed in transsonic and supersonic wind tunnels. The conditions for the occurrence of hysteresis are established by determining the nature of change in certain parameters of an axisymmetric separated flow on a cylinder behind the leading edge while varying the Mach number of the oncoming flow. Two interrelated critical modes are identified in which the separated flow becomes unstable and then spontaneously readjusts to a new stable state under the influence of small perturbations. These modes bound the region of existence of hysteresis. Hysteresis with respect to different variable parameters is analyzed. The flow is found to become unstable when the flow parameters change while holding the shape of the body constant. It is concluded that different hysteresis phenomena in aerodynamics are of a common nature, manifesting the existence of modes of spontaneous avalanche restructuring of the flows. A major role is played in this process at supersonic speeds by the formation and destruction of supercritical flow sections in the region of attachment of viscous layers. Figures 5, references 22: 13 Russian, 9 Western.
[321-6900]

UDC 533.6.011.5:532.517:518.5

NUMERICAL INVESTIGATION OF DETACHED LAMINAR FLOWS OF VISCOUS GAS FLOWING AROUND NEEDLE-TIPPED BODIES AT SUPERSONIC VELOCITY

Moscow IZVESTIYA AKADEMII NAUK SSSR: MEKHANIKA ZHIDKOSTI I GAZA in Russian
No 2, Mar-Apr 84 (manuscript received 16 Dec 82) pp 126-131

PASKONOV, V. M. and CHERANEVA, N. A.

[Abstract] Supersonic longitudinal axisymmetrical flow about a cylinder with a conical nose and needle tip is examined. A numerical investigation employing complete Navier-Stokes equations for a compressible viscous gas is performed. The structure of the flow is studied as a function of the length of the needle and the aperture half-angle of the conical nose of the cylinder. It is demonstrated that steady flow modes exist for point lengths not exceeding the diameter of the cylinder. The total drag of the body can be reduced by needle-tipping, and also by reducing the angle of the conical nose. Figures 5, references 10 Russian.
[321-6900]

UDC 533.6.011.5+533.69.04

PROPULSIVE EFFICIENCY OF VIBRATING WING IN SUPERSONIC FLOW

Moscow IZVESTIYA AKADEMII NAUK SSSR: MEKHANIKA ZHIDKOSTI I GAZA in Russian
No 2, Mar-Apr 84 (manuscript received 26 Oct 82) pp 132-139

KOGAN, M. N. and USTINOV, M. V.

[Abstract] It is shown that the problem of determining the shape of a wing with minimum resistance for a given lifting force can be solved for a vibrating wing by expressing the working force and resistance through the circulation distribution along the wing, finding the optimum circulation distribution and its corresponding minimum resistance and then finding the wing shape (for subsonic velocities); for supersonic velocities the resistance and lifting force can be expressed for the potential on the traveling characteristic surface, and then the wing shape derived. The minimum power required to obtain given lifting force and thrust is determined, and the maximum power received by a wing from a flow for a given resistance is found. The solution is sought within the framework of the linear theory of supersonic flows. The resistance which must be overcome in order to obtain some power is always greater than the amount of thrust which can be obtained with the help of that power. Figures 5; references 2 Russian. [321-6900]

UDC 533.6.011.8

DIFFERENT METHODS FOR DERIVING HYDRODYNAMIC EQUATIONS FOR CHEMICALLY REACTING GASES

Moscow IZVESTIYA AKADEMII NAUK SSSR: MEKHANIKA ZHIDKOSTI I GAZA in Russian
No 3, May-Jun 84 pp 119-125

KOLESNICHENKO, Ye. G.

[Abstract] Methods proposed by various authors for obtaining hydrodynamic equations for chemically reacting gases from the generalized Boltzmann equation are analyzed and found to be deficient. The initial assumptions of the approach developed in three studies do not permit the kinetics of chemical reactions with high activation energy to be investigated. The assertion in seven studies that hydrodynamic equations which are uniformly suitable with respect to α for the densities of the chemical components of a mixture does not follow from the results of those studies, indicating that the methods can be used in real situations only to obtain equations for the populations of vibrational-rotational states of molecules when the differential scattering sections for all nonelastic transitions are uniformly smaller than the differential cross section of elastic collisions. References 15 Russian. [371-6900]

UDC 533.6

DESIGN OF SWIRLED AXISYMMETRIC TURBULENT JETS

Tashkent IZVESTIYA AKADEMII NAUK UZBEKSKOY SSR: SERIYA TEKHNICHESKIKH NAUK in Russian No 2, Mar-Apr 84 (manuscript received 10 Oct 82) pp 51-54

ZHUMAYEV, Z. Sh., ABRAMOV, A. A. and FAYZIYEV, R. A., Institute of Mechanics and Earthquake Immunity of Structures imeni M. T. Urazbayev, UzSSR Academy of Sciences

[Abstract] The problem of swirling a jet for such applications as turbulization of the flame from burners in industrial furnaces or combustion chambers is treated on the basis of steady-state turbulent straight axisymmetric flow of an incompressible fluid with the addition of a tangential velocity component. In the corresponding system of four partial differential equations there appears an exchange coefficient proportional to the mixing half-width squared. After reduction to dimensionless form, this system of nonlinear equations is solved for the appropriate boundary conditions with constant momentum flow and constant moment of momentum. Radial profiles of both axial and tangential velocity components at various distances from the nozzle throat have been calculated numerically by the method of finite differences with an implicit scheme. The maxima of both velocity components are found to decrease and to shift toward the jet axis with increasing distance from the nozzle. A sharp swirl can give rise to a positive pressure gradient sufficiently large to produce a backcurrent. The results agree qualitatively with experimental data. Figures 2, table 1, references 7: 4 Russian, 3 Western. [317-2415]

UDC 533.607+533.46

PROCEDURAL ASPECTS OF TESTING AERODYNAMIC MODELS WITH COMBUSTION IN HIGH-ENTHALPY TRANSIENT-MODE INSTALLATIONS

Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR: SERIYA TEKHNICHESKIKH NAUK in Russian No 4, Iss. 1, Mar 84 (manuscript received 17 Jan 83) pp 68-77

BAYEV, V. K., SHUMSKIY, V. V. and YAROSLAVTSEV, M. I., Institute of Theoretical and Applied Mechanics, Siberian Department, USSR Academy of Sciences

[Abstract] Feed, wind-tunnel balance, pressure, and heat flow instrumentation systems are developed for short-term testing of various models with combustion for different relative positions of the nozzle, the models and the systems that support the models and instrumentation complex. The models are tested in an IT-301 pulsed wind tunnel with various media being input to the model. The models examined are a flat plat for studying spontaneous ignition of fuel

media, or gas dynamic models for investigating the gas dynamics of supplying heat to the channel of the model. A feed system based on the electro-hydraulic effect is developed. The methods used to study the force characteristics and pressure in the models are described. Figures 5, references 20: 17 Russian, 3 Western.
[349-6900]

UDC 532.517.4

USE OF PATTERN RECOGNITION MODELS FOR INVESTIGATING STRUCTURE OF TURBULENT FLOWS

Moscow TEPLOFIZIKA VYSOKIKH TEMPERATUR in Russian Vol 22, No 2, Mar-Apr 84 (manuscript received 18 Jan 83) pp 372-376

POLYAKOV, A. F. and SHINDIN, S. A., Institute of High Temperatures, USSR Academy of Sciences

[Abstract] The possibilities of using pattern recognition methods to study flow structure is investigated. A potential-function pattern recognition algorithm implemented in FORTRAN is employed. A flow in a tube is examined as an example of the application of the pattern recognition method. It was possible in the example to provide a sufficiently rigorous separation of the signal realizations into regions corresponding to turbulent and viscous flow regions. Pattern recognition methods are found promising for studying complex turbulence processes in hydrogas-dynamics and heat exchange. Figures 4, references 9: 5 Russian, 4 Western.
[331-6900]

UDC 532.526.4

INFLUENCE OF FREE CONVECTION ON TURBULENT TRANSFER IN STREAM OF LIQUID ON SLOPING SURFACE

Moscow TEPLOFIZIKA VYSOKIKH TEMPERATUR in Russian Vol 22, No 2, Mar-Apr 84 (manuscript received 4 Apr 83) pp 315-323

POPOV, V. N., Moscow Power Engineering Institute

[Abstract] The influence of free convection on turbulent pulse and heat transfer in a stream of liquids moving along slope and surface is analyzed. A method based on algebraic equations for turbulent friction stresses and heat flux is employed. A steady turbulent flow of a boundary-layered type liquid along a solid surface sloping toward the horizon is examined. It is found that turbulence can be completely suppressed by Archimedean forces with the surface horizontal, or sloping at angles ranging from 0 to θ_0.

The critical values of the gradient and dynamic Richardson numbers are found. Figures 5, references 13: 6 Russian, 7 Western.
[331-6900]

UDC 536.423.2:533.6.011

CHARACTERISTICS OF TWO-PHASE MIXTURE FORMED NEAR SURFACE OF BODY DURING EVAPORATION UNDER CONDITIONS OF STEADY NATURAL CONVECTION

Moscow TEPLOFIZIKA VYSOKIKH TEMPERATUR in Russian Vol 22, No 2, Mar-Apr 84 (manuscript received 25 Apr 83) pp 346-354

VRYKIN, M. V., Institute of High Temperature, USSR Academy of Sciences

[Abstract] A stationary heated body in an infinite volume of cold inert gas whose temperature and pressure are known at infinity is examined. The free convective flow of the heterogeneous mixture of gas, vapor and condensate particles about the body is considered. Equations describing inter-phase momentum transfer are derived, and the number of condensation centers is calculated. It is found that the vapor escaping from the surface is saturated when the evaporation rates are substantially subsonic, and that the vapor becomes cooler and saturated as the distance from the surface increases. The volumetric condensation of vapor at moderate and high evaporation rates is found to have little influence on the relationship between the partial vapor pressure near the surface and the evaporation rate, although it changes the thermal and dynamic characteristics significantly as compared with the case of noncondensing vapor. Figures 7, references 12: 8 Russian, 4 Western.
[331-6900]

UDC 534.222.2

INTER-PHASE HEAT AND MASS EXCHANGE FOLLOWING SHOCK WAVE MOVING ALONG FILM OF LIQUID FUEL

Moscow VESTNIK MOSKOVOGO UNIVERSITETA: SERIYA I, MATEMATIKA, MEKHANIKA in Russian No 3, May-Jun 84 (manuscript received 8 Apr 82) pp 93-96

GENDUGOV, V. M. and ZINOV'YEV, A. S.

[Abstract] Gas dynamic parameters on the surface of a film of liquid fuel along with a shock wave propagates in a gaseous oxidant are determined. Equations are derived for the laminar boundary layer with chemical reactions for the compressed gas mixture. The temperature behavior of the surface of a film of liquid n-hexadecane is investigated as a function of the Mach number of the shock wave and the mass concentration of oxygen in a nitrogen mixture. References 2 Russian.
[341-6900]

EXPLOSIVE DYNAMICS OF TURBULENCE SPECTRUM DURING DECAY INTERACTION OF WAVE

Moscow ZHURNAL EKSPERIMENTAL'NOY I TEORETICHESKOY FIZIKI in Russian Vol 86, No 2, Feb 84 (manuscript received 1 Jun 83) pp 462-469

BREYZMAN, B. N. and ROZENRAUKH, Yu. M., Institute of Nuclear Physics, Siberian Department, USSR Academy of Sciences

[Abstract] Explosive evolution of the initial wave spectrum, in which the energy is pumped into the dissipation region within approximately the nonlinear interaction time of the waves in the original spectrum, is demonstrated. It is found that the decay processes can cause spontaneously accelerating pumping of wave energy into the region of wave numbers extending to the absorption region. Capillary waves on the surface of a liquid and electron waves in a plasma are used as an example to demonstrate the spectral dynamics during decay. The possbility of spontaneously accelerated transfer of energy to the shortwave region of the spectrum due to decay processes is interpreted as following naturally from the fact that the waves examined are hydrodynamic in nature. References 5 Russian.
[323-6900]

NONLINEAR DYNAMICS OF WAVE PACKETS IN DISSIPATIVE MEDIUM

Moscow ZHURNAL EKSPERIMENTAL'NOY I TEORETICHESKOY FIZIKI in Russian Vol 86, No 2, Feb 84 (manuscript received 3 Jun 83) pp 470-478

FABRIKANT, A. L., Institute of Applied Physics, USSR Academy of Sciences

[Abstract] The change in the spectrum of the envelope solitons of a weakly nonlinear wave due to linear and nonlinear dissipation (instability) with arbitrary spectral dependency is investigated. The evolution of Schrodinger and Langmuir solitons is analyzed. The process of nonlinear evolution of quasimonochromatic packets is found to incorporate decay into envelope solitons with high frequency carriers, for which the wave number then shifts adiabatically across the spectrum under the influence of weak dissipation or instability. It is demonstrated that envelope solitons in an active medium become equalized with respect to amplitude and wave number. If quasimonochromatic wave packets with different wave numbers are excited on the boundary of an amplifying medium, they become transformed to a sequence of identical solitons as they propagate. The rate of amplitude attenuation and change in wave number of gravity waves at the surface of deep water are calculated for a viscous dissipation process occurring in the nonlinear mode. Scattering of the mean flow by bottom irregularities is found to have a strong influence on the evolution of wave packets with very high amplitude. References 13: 12 Russian, 1 Western.
[323-6900]

UDC 532.516

ENTRAINMENT OF LIQUID BY WITHDRAWN CYLINDER

Novosibirsk ZHURNAL PRIKLADNOY MEKHANIKI I TEKHNICHESKOY FIZIKI in Russian
No 2, Mar-Apr 84 (manuscript received 24 Feb 83) pp 22-27

BAYKOV, V. I., SHUL'MAN, Z. P. and ENGEL'GARDT, K.

[Abstract] The thickness of the liquid film remaining on the surface of a cylinder withdrawn vertically from a container of liquid at a fixed rate is analyzed by calculating the effect of internal friction, mass forces and surface tension. The influence of these forces on the entrainment of liquid is determined mainly by the rate of withdrawal and the physical properties of the medium. An analytical approach is developed that is valid for a very wide range of withdrawal rates. Figures 5, references 5: 1 Russian, 4 Western.
[320-6900]

UDC 532.51.013.4

INVESTIGATION OF STABILITY OF FLOW OF FILM OF LIQUID METAL FORMED BY INTENSE INTERACTION OF ELECTRON BEAM

Novosibirsk ZHURNAL PRIKLADNOY MEKHANIKI I TEKHNICHESKOY FIZIKI in Russian
Vol 144, No 2, Mar-Apr 84 (manuscript received 14 Mar 83) pp 99-105

ZORIN, Yu. P. and MAL'TSEV, O. Yu.

[Abstract] The planar flow of a film of molten metal under the influence of gravity and electron pulses is examined as a first approximation for the flow of metal along the melting front during electron beam welding. The steady-state distribution of the stream function and temperature is determined, and the hydrodynamic stability of the steady-state flow with respect to infinitesimal two-dimensional perturbations is investigated. A system of equations describing the perturbation amplitudes is derived and solved. The flow of a film of molten iron is analyzed as an example. Figures 2, references 5 Russian.
[320-6900]

GAS DYNAMIC PROCESSES OCCURRING DURING PULSE HEAT RELEASE IN SIGNIFICANTLY SUBSONIC FLOW OF VISCOUS GAS

Leningrad ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 54, No 4, Apr 84 (manuscript received 6 Jun 83) pp 846-848

ZHMAKIN, A. I. and MAKAROV, Yu. N., Physical-Technical Institute imeni A. F. Ioffe, USSR Academy of Sciences

[Abstract] Instantaneous heat release in a flat channel through which a gas is pumped at rates far below the speed of sound is modeled. The boundary conditions are those which hold, e.g. when a gas is pumped through a porous wall and the outlet of the channel is connected to a large reservoir. The formulas derived are solved numerically as an example. It is found that hot gas is first released from the bottom of the channel, which weakens the higher-pressure region and causes the non-isothermic region near the top wall to move slowly. Figure 1, references 9: 5 Russian, 4 Western.
[319-6900]

UDC 519.6:533.7

NUMERICAL METHOD FOR COMPUTING SUPERSONIC FLOW OVER WINGS OF FLIGHT VEHICLES

Moscow ZHURNAL VYCHISLITEL'NOY MATEMATIKI I MATEMATICHESKOY FIZIKI in Russian Vol 24, No 6, Jun 84 (manuscript received 23 Dec 82 after revision) pp 900-915

VOSKRESENSKIY, G. P.

[Abstract] A numerical method is described for calculating the supersonic flow over wings with blunted and tapering profiles. The proposed algorithms are based on a numerical method for computing supersonic spatial flow over tapered bodies proposed elsewhere and extended to the flow over a blunted elongated body. The domain of the solution above and below the wing is represented in an original cartesian coordinate system in the form of three subdomains. Transformation of the coordinates for all three subdomains is explained. The three resulting problems are combined under the concept of finite-difference schemes and the solution of difference equations. The method is illustrated on the basis of a number of examples. Figures 9, references 16: 15 Russian, 1 Western.
[393-6900]

OVERVIEW OF RECENT ADVANCES IN LASER APPLICATIONS

Moscow TRUD in Russian No 89 (19236) 15 Apr 84 p 2

[Article by N. G. Basov, "Energy of the Future"]

> [Text] On the eve of Soviet Science Day, the editors of TRUD asked Academician N. G. Basov, a distinguished scientist, twice Hero of the Soviet Union, Lenin and Nobel Prize laureate, and member of the Presidium of the USSR Supreme Soviet, to talk about the future development of laser optics.

The demand for energy inevitably rises with improvement of the people's standard of living and increase in the rate of scientific and technical progress. But the sources of energy are not exhaustible.

So, we will be deprived of coal, oil, and gas. What can we do? The dramatic impact and significance of the energy problem is difficult to even imagine. As often happens in crisis situations, science has indicated a way out. Scientists have proposed the idea of controlled thermonuclear fusion, which is based on the fusion reactions of hydrogen isotopes. In our view, this could give mankind a powerful source of energy in the near future, and avert the threat of energy starvation.

In our times we have witnessed the rapid development of atomic power plants. They produce electrical energy through the fission of heavy nuclei. The most long-range prospect in the field of atomic energy is the fast neutron reactor, in which the fission of the inexpensive isotope uranium-238 goes on. There are quite large reserves of this uranium isotope, enough to supply a society with high energy demands for a million years. But it has its difficulties,..

The control of thermonuclear fusion solves the energy problem in a cardinal way. It ensures an essentially "infinite" energy abundance.

The scientists of various countries are proceeding toward the control of nuclear fusion by two methods. The first is by "slow" heating of a plasma confined for long periods of time by a magnetic field. The time is determined by the number of thermonuclear reactions in the rarified plasma--there is one particle per cubic centimeter of plasma, approximately one

one-hundredth the number of molecules in a cubic centimeter of air--needed to produce a significant amount of energy. By general consensus, "Tokamak"-type installations, invented in our country at the Atomic Energy Institute imeni I. V. Kurchatov, occupy a leading position in this field.

The other method is the inertial pulse system. In this event, the fusion reaction is achieved by compressing tiny targets filled with thermonuclear fuel by means of powerful pulses of laser light. You might ask what could happen in one billionth of a second--namely, the duration of the laser pulse? As it turns out, this is enough time for hard globules of deuterium ice acted on by laser light to explode, becoming thermonuclear plasma, heated to one million degrees centigrade. At present, it is unfortunately difficult to assess the full significance of the technical and technological capabilities made possible by the utilization of energy given off in the fusion of heavy hydrogen isotopes caused by these thermonuclear microexplosions.

Recent years have been marked by rapid progress towards solving the problems of laser thermonuclear fusion. Powerful multichannel laser complexes are already operating in various countries. One of these is the "Del'fin" - a 108 beam neodymium-glass laser, put into operation in 1981 in the Physics Institute imeni P. N. Lebedev (FIAN). These installations have already achieved stable thermonuclear plasma densities of 10-30 gm/cm^3 and temperatures in the tens of millions degrees centigrade, and produced record numbers of neutrons. Our experiments at the Institute with the "Del'fin" apparatus fully supported the concepts of Soviet scientists about laser thermonuclear fusion, and gave us detailed insights into the processes occurring when laser light acts on a thermonuclear target.

Does this mean that the problem has already been conclusively solved? We cannot yet say it has. We have yet to reach the so-called physical threshold. In other words, the thermonuclear reaction must yield as much energy as was expended in delivering laser light to the targets. Achieving this threshold would signify a decisive transition from the realm of physics research to engineering design of inertial thermonuclear reactors, i.e. facilities that convert the energy of thermonuclear microexplosions to more "usable" forms of energy.

From our point of view, the choice of the type of laser for the demonstrative experiment is the fundamental problem of laser thermonuclear fusion. The goal of the experiment is to achieve the physical threshold mentioned above. I think that new laser design research now being conducted throughout the world, as well as at FIAN, will give us an affirmative answer to this question in the very near future.

Right now it is difficult to name an exact date when use of thermonuclear energy will become economical. But various types of reactors are already being planned, which will put thermonuclear energy to the service of mankind. One particularly alluring possibility, for example, is the so-called fission-fusion reactor. In it, the fusion of heavy hydrogen isotopes and the fission of uranium atoms occur simultaneously. We could more simply solve the energy

balance problem by temporarily sacrificing a thermonuclear system's primary advantage--its cleanliness, in terms of an almost total lack of radioactive waste. The fission-fusion reactor, intermediate between stationary nuclear reactors and thermonuclear systems and feasible with present laser technology, is such a "compromise", which will bring us to the goal more efficiently.

An even more alluring prospect is the reactor that will manufacture chemical fuel, in part hydrogen, as a result of thermonuclear reactions. The capability of building such a reactor in principle signifies a revolution in the energy supply and demand system. Imagine conventional power plants operating on hydrogen fuel, cars burning hydrogen instead of gasoline, various everyday "hydrogen" devices, and much, much more.

Now I want to talk about other fields where the discoveries of scientists and physicists may lead to drastic changes. Needless to say, physics was greatly changed by the advent of the computer, making routine work of problems previously considered unsolvable. Today computers redesign research equipment and process experimental data. A whole new field has appeared--mathematical modeling of experiments.

In talking about future developments in computer technology, we should foresee the substantial impact laser optics will have in the near future. It's well known that even a very short beam of light will transmit a huge volume of information. Here's a little example for illustration. When mankind learned how to produce electromagnetic radiation of kilometer wavelengths, he became able to transmit sound--the advent of radio. By opening up the meter wavelength range, people discovered television: the simultaneous transmission of sound and image. Having the key to the visible spectrum gives us a colossal increase in the volume of information with which we can work. For example, we can transmit the information contained in a hundred television programs through a light pipe with one-micron wavelength laser light.

A most important element in optoelectronics is the semiconductor injection laser, the most compact of all lasers. It's a fraction of a millimeter in size. This laser is highly efficient, and is powered by ordinary penlight batteries. Prototypes of these lasers with long service lifetimes and optimized parameters have been made possible by research conducted by FIAN scientists and branch institutes. By our industrial production of these lasers, we could solve many problems in communication optics, navigation, infrared optics, and optical memories.

The perfecting of low-loss optical fibers and light tubes is a powerful achievement of the past ten years (light is attenuated less than 10 percent by passing through one kilometer of such fiber). This invention enables us to direct laser light to any point in space, radically restructuring many communication, measurement and control systems.

With optoelectronics, we can build computer memory systems, significantly increase their storage density, and accelerate information location and

retrieval systems. With optics techniques, we can store information on one one-hundredth the space needed by the most advanced magnetic records. And the manufacture of optical storage disks is simpler and cheaper than magnetic disks.

Completely unique possibilities arose in high capacity computer memories when FIAN scientists created a material that looks like a sandwich made of semiconductor and dielectric layers. By setting up a voltage across this sandwich, a redistribution of electrons occurs in regions illuminated by laser light. The possibilities are that an operating memory system of a billion bits - this corresponds to the information contained in a hundred books of a thousand pages each - could be structured around a single four square meter square of this material.

Only twenty years ago lasers were the domain of institutes and laboratories. Now their applications extend more and more to industry. One can definitely assert: production efficiency in the near future will depend to a significant extent on the rate of development and application of industrial lasers.

At the foundation of laser technology are the singular properties of laser light. They can focus a light flux of colossal density in a given region. The possibilities arise for solutions to a wide range of problems in materials processing. Undesirable effects connected with the heating of neighboring parts are avoided, and important surface microhardening is ensured. A realtively simple dosing of laser light can provide practically any range of temperatures, which in the final analysis determines one or another type of processing technology.

Today such heat treatment is already being applied, such as laser case hardening of metals, surface alloying, and laser vitrification (creation of a surface layer with a structure different from the structure of the underlying material). For example, the relatively simple operation of laser treating stamping machines increases their durability 3-4 times. Laser treating of the working edge on cutting tools significantly increases its surface microhardness, and as a result tool durability is 2-3 times greater.

With laser heat treatment we can improve the effectiveness of machine parts and subassemblies, including those used in agriculture.

Laser light has opened a way to weld items of dissimilar materials. Absence of strain, contraction of the materials and deep fusing are characteristic of this operation. Power consumption for laser welding is characteristically several times less than that for electric arc welding. At the same time we get a higher quality weld and higher productivity.

And finally, lasers can rivet materials which won't submit to welding by any other means. Add to this the ability to weld parts at great distances from the laser source, as well as the possibility of full automation. Laser welding is successfully replacing riveting and electric arc welding in various bearing assemblies, and enabling more effective securing of protective collars for bearings while avoiding deformations and loss of tolerance.

The possibilities laser light gives us for the cutting of various materials cannot be overstated. It can be used on any material and leaves a good quality edge needing no additional machining. The cutting of complex patterns can be automated, ensuring a clean process (free of dust, noise, vibration, etc.).

Lasers can also be effectively employed for advancing other technologies, such as various control systems. Laser light can permit measurement and control of sizes, angles, and linear displacements.

From this one short list we can clearly see the benefits we can receive from a broad utilization of laser technology in different industries. A specialized branch of our Institute has been established in Kuybyshev for accelerating this utilization. Today the future of laser technology demands not just the mass production of powerful industrial lasers, but also overcoming psychological barriers in management. We need to look bravely towards the future, not to be fearful of taking justifiable risks. Increased practical application of advanced scientific ideas has yielded and will yield a high return.

12733
CSO: 1862/418

UDC 681.7

DIFFERENCE-FREQUENCY EMISSION IN MILLIMETER WAVELENGTH REGION BY CO_2 LASER

Yerevan DOKLADY AKADEMII NAUK ARMYANSKOY SSR in Russian Vol 78, No 2, 1984 pp 66-69

BAGDASARYAN, D. A., MAKARYAN, A. O. and POGOSYAN, P. S., Yerevan State University

[Abstract] The angular distribution of the difference-frequency radiation power in the millimeter wavelength band with mixing of the frequencies of a TEA CO_2 laser in GaAs crystal is investigated. An optimal beam radius is obtained by achieving phase agreement through the interaction of the angular components of the colinear exciting beams. Difference-frequency radiation power is measured as a function of the radius of the exciting beam. The results indicate that the method can provide powerful directional radiation in the millimeter wavelength band.
[339-6900]

UDC 621.315.592

LOW-THRESHOLD VISIBLE GaInAsP/GaAsP DUAL HETEROSTRUCTURE LASERS (T=300 K, λ=0.70-0.66 μm, I_{thr}~1.5-3.2 kA/cm^2)

Leningrad FIZIKA I TEKHNIKA POLYPROVODNIKOV in Russian Vol 18, No 4, Apr 84 (manuscript received 8 Dec 83) pp 757-758

ALFEROV, Zh. I., ARSENT'YEV, I. N., VAVILOVA, L. S., GARBUZOV, D. Z., TIKUNOV, A. V. and IGNATKINA, R. S., Physical-Technical Institute imeni A. F. Ioffe, USSR Academy of Sciences

[Abstract] The possibility of obtaining low-threshold laser GaInP-GaInAsP-GaInP dual heterostructures suitable for building CW radiators operating in the 0.70-0.66 μm band is examined. The substrates for the structures consist of GaAsP layers grown on n-GaAs (100) single crystals. The basic parameters for a number of heterostructures grown on GaAsP layers of 6

different compositions are tabulated. The Ga-In-As-P dual heterostructure lasers fabricated are practically the same throughout the 0.66-0.79 μm region and can be used to fabricate CW red radiators. Figures 2, references 6: 3 Russian, 3 Western.
[322-6900]

UDC 535.375

TRANSFORMATION OF ENERGY SPREAD OF LASER PUMPING VIA PHASE CONJUGATION

Yerevan IZVESTIYA AKADEMII NAUK ARMYANSKOY SSR: FIZIKA in Russian Vol 19, No 2, Mar-Apr 84 (manuscript received 25 Feb 83) pp 81-85

ARUTYUNYAN, V. M., AGADZANYAN, S. A., MURADYAN, A. Zh. and PAPAZYAN, T. A., Scientific Research Institute of Physics of Condensate Media, Yerevan State University

[Abstract] Nonlinear reflection of ultrashort high-energy laser radiation pulses leaving the interaction space is more effective than that of continuous-wave radiation, but depends largely on the statistical spread of energy fluctuation. Therefore, transformation of the spread of pumping energy into the spread of energy in the conjugate wave plays an important role in the process. An experimental study was made of this transformation in a laser on a resonant dye of the polymethine group. The pumping source was a PPGS-1 single-mode parametric laser emitting pulses of 30-40 ps duration and 50 mJ energy. A semitransparent mirror with a reflection coefficient R = 0.45 split the laser beam into two approximately equal parts, each guided by a set of swivel prisms into a test cell with 3955 polymethine dye from exactly opposite directions as reference pumping waves, and a small part of the order of 0.04 guided by a wedge, an optical delay line, and a mirror with a reflection coefficient R = 1.0 into the interaction space as probing wave. All three coherent waves excited in the millimeter thick layer of 3955 dye in ethanol solution were equalized by means of two other optical delay lines, the probing wave then passing through a phase plate and the conjugate wave reflected by a mirror with a reflection coefficient R = 0.3 into a photoreceiver with scanning diaphragm. The laser radiation energy at fundamental frequency (λ = 1.06 μm wavelength) and at second-harmonic frequency (λ = 0.53 μm wavelength) was measured with two separate instruments, parasitic radiation having been blocked by two black diaphragms. The results show the dependence of phase conjugation efficiency on the power density of the pumping waves, with the reflection coefficient for the conjugate wave peaking within some range of the pumping intensity and also within some range of the dye concentration. The energy-spread transformation coefficient was found to dip to a minimum within the same ranges of pumping intensity and dye concentration while remaining larger than unity. The results indicate, however, that, by optimizing the three-wave or degenerate four-wave interaction in a resonant dye, it is possible to make the energy spread in the conjugate wave smaller than the spread of pumping energy. Figures 3, references 13: 4 Russian, 9 Western.
[316-2415]

UDC 621.373.8:535.31

RESONANT PHOTOEXCITATION AS LASER PUMPING MECHANISM IN FAR ULTRAVIOLET REGION OF SPECTRUM

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 11, No 4, Apr 84
(manuscript received 5 Apr 83) pp 653-660

VINOGRADOV, A. V., CHICHKOV, B. N. and YUKOV, Ye. A., Physics Institute imeni P. N. Lebedev, USSR Academy of Sciences

[Abstract] The possibility of obtaining resonant photopumping to achieve gain of 2-10 cm^{-1} on hydrogen-like ions with nucleus charges z=2-8 in the region of a few tens of nanometers is investigated. The parameters of the active medium and requirements for pumping intensity are analyzed. The laser arrangement employed is described. It is found that resonant photopumping can be used to obtain gains of g=2-10 cm^{-1} on $n=3\rightarrow n'=2$ hydrogen-like ion transitions of low frequency, requiring radiation flux density in one spectral line of approximately 10^7-10^9 W/cm^2. The parameters obtained can be realized on experimental laser plasma heating setups with pulse energies of a few tens of joules. Figures 6, references 20: 6 Russian, 14 Western.
[332-6900]

UDC 621.373.826.038.823

CHARACTERISTICS OF RADIATION OF GAS LASER WITH LASING REGION TUNED BY STRONG MAGNETIC FIELD

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 11, No 4, Apr 84
(manuscript received 23 Mar 83) pp 673-680

IZMAYLOV, A. Ch., Moscow Engineering-Physics Institute

[Abstract] The polarization of an active gas medium contained in a strong magnetic field of varying configuration is analyzed from the viewpoint of quantum mechanics for the case of two-frequency lasing with the Zeeman splitting of the line significantly exceeding the Doppler broadening. The amplitude and frequency characteristics of the radiation of a two-frequency gas laser with controllable internal phase anisotropy are investigated. The influence of depolarizing atom collisions is found to be significant. The intensity of a single-mode Zeeman-tuned laser is investigated. The theoretical results are compared with experimental findings, and the possibility of exploiting some of the qualitative characteristic of the behavior of laser radiation when strong magnetic fields are applied is discussed. Figures 3, references 17: 12 Russian, 5 Western.
[332-6900]

UDC 621.378.335.8

STABILIZATION OF FREQUENCY OF ILGN-202 INTERNAL-MIRROR LASER

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 11, No 4, Apr 84
(manuscript received 13 May 83) pp 709-714

VLASOV, A. N., KASEL'SKIY, V. A., PEREBYAKIN, V. A. and POLYAKOV, S. Yu.

[Abstract] The possibility of developing a single-frequency stabilized laser on the basis of the commercially produced ILGN-202 radiator is investigated. Mode intensity is analyzed as a function of radiation frequency, and the difference is used as a benchmark for an automatic frequency control system. The parameters of the temperature regulation system of the optical cavity are calculated, and the characteristics of the stabilized laser are examined. Short-term frequency stability of $5 \cdot 10^{-9}$ is achieved. It is found that laser frequency stability can be improved by reducing the noise at the output of the photodetector and by optimizing the AFC system. The use of a polarized filter with the appropriate orientation makes it possible to obtain single-frequency operation. Figures 4, references 6: 4 Russian, 2 Western.
[332-6900]

UDC 621.373.826.038.823

INVESTIGATION OF FACTORS LIMITING SERVICE LIFE OF COPPER BROMIDE VAPOR LASER

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 11, No 4, Apr 84
(manuscript received 6 Jul 83) pp 808-813

ASTADZHOV, D. A., VUCHKOV, N. K., PETRASH, G. G. and SABOTINOV, N. V., Institute of Solid State Physics, Bulgarian Academy of Sciences, Physics Institute imeni P. N. Lebedev, USSR Academy of Sciences

[Abstract] Experiments are conducted on a copper bromide vapor laser with a discharge tube made of fused quartz to study the factors limiting the service life of a pulsed copper bromide vapor laser. It is found that a laser that is fully heated up during operation can operate for more than 300 hours, and that service life can be extended by using devices in the discharge tube to maintain the concentration of free bromide at the required level and by increasing the distance between the exit pupils and the discharge zone. Figures 4, references 9: 7 Russian, 2 Western.
[332-6900]

UDC 621.373.826

SINGLE-FREQUENCY OSCILLATION IN DYE LASER WITH MIXED LUMPED-DISTRIBUTED FEEDBACK

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 11, No 4, Apr 84
(manuscript received 31 Oct 83) pp 815-817

PASHININ, P. P., RASPOPOVA, S. F. and SUKHODOL'SKIY, A. T., Institute of General Physics, USSR Academy of Sciences

[Abstract] The effectiveness of lumped-distributed feedback in dye lasers to obtain narrowband lasing is demonstrated experimentally by using Bragg diffraction on a distributed periodic structure and external dispersion cavity. A simple laser is fabricated that combines the effective frequency selection of distributed-feedback lasers and the low divergence and good stability of radiation provided by lasers with external cavities. The experimental findings indicate that lumped-distributed feedback is promising for tunable dye lasers, in which tuning is provided by changing the period of the grating and length of the cavity simultaneously. Figures 2, references 3 Russian.
[332-6900]

UDC 621.373.826

FLASHLAMP-PUMPED COLOR-CENTER LASER

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 11, No 4, Apr 84
(manuscript received 16 Aug 83) pp 817-818

Vratskiy, V. A., KOLEROV, A. N. and KUZ'MINA, Ye. Ye., All-Union Scientific Research Institute for Physical-Technical and Electrical Engineering Measurements

[Abstract] Stimulated emission is obtained on F_2 color centers in LiF pumped by incoherent light. Color-center lasing is recorded in the 620-670 nm band, with spectral tuning achieved by changing the dye concentration, cavity alignment and electrical pumping energy. Flashlamp-pumped LiF:F_2 lasing is found to have better conversion efficiency than laser excitation, and the construction of the laser radiator is significantly simpler. Figures 2, references 3: 2 Russian, 1 Western.
[332-6900]

UDC 621.375.826+621.315.59

INFLUENCE OF DEEP IMPURITY LEVELS ON THRESHOLD CHARACTERISTICS OF ELECTRON-BEAM PUMPED n-Ga_{1-x}-Al_xAs LASERS

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 11, No 4, Apr 84
(manuscript received 7 Jul 83) pp 833-835

BOGDANKEVICH, O. V., BORISOV, N. A., GALCHENKOV, D. V., USVYAT, I. I. and CHERNYSHEVA, O. V., All-Union Scientific Research Center for the Study of Surface and Vacuum Properties

[Abstract] The influence of doping on the radiation properties, especially the lasing threshold, of semiconductor lasers is examined. The influence of impurity states associated with the indirect L-minimum of the conduction band is examined by introducing a nonradiative recombination channel. The optimal doping values for n-type Ga_{1-x}-Al_xAs are found to depend upon the composition of the solid solution because of the influence of the nonradiative recombination channel. Figures 2, references 11: 6 Russian, 5 Western.
[332-6900]

UDC 621.375.8

INVESTIGATION OF INFLUENCE OF SMALL ADDITIONS OF TRI-N-PROPYLAMINE ON OUTPUT CHARACTERISTICS OF TEA CO_2 LASER

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 11, No 4, Apr 84
(manuscript received 1 Aug 83) pp 835-838

PETUKHOV, V. O. and CHURAKOV, V. V., Institute of Physics, Belorussian SSR Academy of Sciences

[Abstract] The influence of the ionizable additive tri-n-propylamine (PPA) on the vibrational temperatures and output parameters of a TEA CO_2 laser operating in the fundamental and second sequence bands is investigated. A working mixture of CO_2:N_2:He=1:1:3 is employed. The mechanism underlying the effect of PPA molecules on the CO_2 laser can be split into two basic competing factors: increased efficiency of excitation of the CO_2 V_3 mode and N_2 oscillation on the one hand, and strong deactivation of the vibrational energy stored in the CO_2 V_3 mode on the other. Figures 3, references 7: 5 Russian, 2 Western.
[332-6900]

UDC 621.373.826.038.823

CASCADE-TRANSITION CO_2 OPTICAL FEEDBACK GDL

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 11, No 4, Apr 84 pp 849-851

BIRYUKOV, A. S., SERIKOV, R. I., STARIK, A. M. and SHCHEGLOV, V. A.

[Abstract] Numerical calculations of the energy characterics of a pulsed periodic three-frequency CO_2 GDL confirm a significantly greater relative power increase on the second transition of the cascade using CW feedback at λ=10.4 μm than for a single frequency laser. It is demonstrated that the specific output energy in the long-wavelength transition (λ=16.2 μm) can be more than doubled. Figures 2, references 3 Russian.
[332-6900]

UDC 621.373.826.038.825.2

LASING KINETICS AND APPLICATION OF RADIATION OF PERIODIC Q-SWITCHED FLASHPUMPED YAG:Nd-LASER

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 11, No 5, May 84
(manuscript received 1 Jun 83) pp 880-886

DENISOV, N. N., MANENKOV, A. A., PROKHOROV, A. M., Institute of General Physics, USSR Academy of Sciences

[Abstract] The formation of giant pulses in a periodic Q-switched flash-pumped YAG:Nd laser, involving the accumulation of inversion between lasing pulses and the kinetics underlying the generation of trains of giant pulses, is investigated. The influence of superluminescence on the amplitude and temporal behavior of the laser radiation is studied. Experimental findings with respect to the lasing kinetics of a YAG:Nd laser in the giant-pulse train mode are interpreted theoretically. The amplitude and temporal behavior of a laser YAG:Nd amplifier for giant pulse trains are investigated experimentally. It is found that YAG:Nd lasers can operate effectively with quasisteady flashpumping and periodic Q-switching to produce periodic trains of giant pulses with relatively high repetition frequencies of up to f=200 KHz. The train repetition frequency is determined by the heat profile of the laser element, and can be raised to 20 Hz with no significant degradation in the divergence of the laser radiation due to thermoelastic stresses in the element. It is shown theoretically and experimentally that superluminescence in the YAG:Nd active crystal has a strong influence on the temporal and amplitude behavior of the laser. Figures 9, references 9: 5 Russian, 4 Western.
[386-6900]

UDC 621.378.33

GAS HEAT LENS IN COPPER-VAPOR LASER

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 11, No 5, May 84
(manuscript received 22 Jun 83) pp 918-923

ZHARIKOV, V. M., ZUBOV, V. V., LESNOY, M. A., LYABIN, N. A. and CHURSIN, A. D,

[Abstract] The gas heat lens effect due to inhomogeneity of particle concentration (temperature) over the cross section of the discharge channel in a copper-vapor laser can have a decisive influence on optical characteristics of the active medium. In this paper, the authors study the parameters of the effect in such a laser, using these parameters to calculate gas temperature. Experiments were done on the active element of a laser with discharge channel 2 cm in diameter and 50 cm long. Neon was the buffer gas. A helium-neon laser beam was passed through the active medium with diameter of about 1 mm at input. Because of radial inhomogeneity of particle concentration in the active element resulting from nonuniform gas temperature, the He-Ne laser beam was deflected by different amounts, depending on distance from the axis of the discharge channel. Beam deflections were measured as a function of input power and buffer gas pressure. It is shown that gas temperature is determined mainly by input power, and that increasing pressure does not cause any appreciable change in heat conduction of the gas or discharge contraction. An expression is given for determining the gas temperature on the axis of the active element as a function of the linear input power to the discharge. Error analysis shows that gas temperature determination by the proposed method is accurate within $\pm$7-8%. Figures 8, references 8 Russian.
[386-6610]

UDC 621.378.325

MAGNETOOPTICAL EFFECTS IN SOLID-STATE YAG:Nd^{3+} LASER WITH NON-PLANAR CAVITY

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 11, No 5, May 84
(manuscript received 23 Jun 83) pp 943-949

NANIY, O. Ye., and SHELAYEV, A. N., Moscow State University imeni M. V. Lomonosov

[Abstract] The polarization, amplitude and spectral characteristics of a continuous rotating YAG:Nd^{3+} solid state ring laser with a non-planar cavity are investigated experimentally for polarization-frequency decoupling of the colliding waves and splitting of the amplification line of the active substance due to the Zeeman effect. An extraordinary lasing mode is detected

in which one of the waves has circular polarization, and the colliding wave has linear modulation. Magnetooptical effects can be used to obtain varying transverse structure of the fields of the colliding wave. The radiation direction of the ring laser is switched with no transient at the relaxation frequency through magnetooptical modulation. Magnetooptical feedback by the difference of the intensities of the colliding waves reduces concurrent suppression significantly and facilitates a beating mode over a wide range of frequency splitting of the colliding modes. Stable bi-directional lasing with different frequencies of colliding waves is obtained, as well as unidirectional single-mode conditions with polarization, frequency and irection switching. Figures 5, references 10: 9 Russian, 1 Western.
[386-6900]

UDC 621.373.826.038.823

ELECTRIC DISCHARGE CHAMBER FOR COAXIAL CO_2 LASERS

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 11, No 5, May 84
(manuscript received 28 Jun 83 after revision) pp 957-961

KOLESNIKOV, V. Yu., ORLOV, B. V., POL'SKIY, Yu. Ye. and KHOKHLOV, Yu. M.,
Kazan' Aviation Institute

[Abstract] The basic characteristics of a metal discharge chamber with a dielectric fiberglass-enamel coating are investigated. The effectiveness of pre-ionization of the gas by short pulses is determined by investigating the current-voltage characteristics of the primary discharge. Effective pre-ionization of the gas makes it possible to eliminate ballast resistances in the power supply circuit, which improves the efficiency of the radiator. The elimination of glass parts makes it possible to create a simple, reliable construction of an electric discharge chamber exhibiting good energy and optical characteristics. The useful features of the chamber described are realized in the compact Yupiter process laser. Figures 5, references 9 Russian.
[386-6900]

UDC 621.375.826

DIRECT OSCILLOGRAPHIC INVESTIGATION OF CHARACTERISTICS OF ACTIVE MODE-LOCKED YAG:Nd^{3+} LASER

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 11, No 5, May 84
(manuscript received 15 Jul 83) pp 1033-1037

APANASEVICH, P. A., ZAPOROZHCHENKO, V. A., KACHINSKIY, A. V., PETRYAKOV, V. M., SOBOLEV, S. S., TYPETS, N. A. and CHALKIN, S. F., Institute of Physics, Belorussian SSR Academy of Sciences

[Abstract] Active mode-locked solid state lasers are investigated in order to obtain highly stable reproducible ultrashort pulses. The energy and temporal parameters of the ultrashort pulses generated by an active mode-locked pulse-periodic YAG:Nd^{3+} laser are investigated as a function of the difference between the modulation frequencies and inter-mode beating, as well as the pumping level of the active substance; the influence of the intercavity Fabry-Perot etalon on the characteristics of the ultrashort pulses is studied. The time measurements are performed by high speed oscillography in real time. The intensity of a single pulse under optimal conditions was approximately100 MW/cm^2, with a duration of 70 ns and near-diffraction divergence. Figures 5, references 20: 9 Russian, 11 Western. [386-6900]

UDC 621.373.826.038.823

MICROWAVE-EXCITED STRONTIUM-VAPOR ION LASER

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 11, No 6, Jun 84
(manuscript received 10 Jan 84) pp 1077-1078

KRAVCHENKO, V. F., MIKHALEVSKIY, V. S., CHUBAR', S. P. and SHELEPO, A. P., Scientific Research Institute for Physics, Rostov State University imeni M. A. Suslov

[Abstract] Lasing on self-limiting transitions of strontium ions in a microwave-pulse excited strontium-vapor laser is investigated using an experimental setup consisting of a lamp modulator, and MI-189G magnetron, incident and reflected powerrmeters, a waveguide circuit and a device for injecting microwave power into the discharge tube. Lasing is obtained when the device is heated up to 480°C and the helium pressure reaches 30-40 mm Hg. The main condition for lasing with relatively low-power microwave excitation is found to be high residual ionization. The efficiency of microwave versus RC-discharge excitation is found to be nearly the same. The use of pulse-periodic microwave discharges is found to be promising for pulsed gas lasers based on self-limiting transitions. References 3: 2 Russian, 1 Western. [400-6900]

UDC 621.373.826.038.825.2

EFFECTIVE COMPRESSION OF PICOSECOND PULSES FROM YAG:Nd^{3+} LASER

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 11, No 6, Jun 84
(manuscript received 27 Feb 84) pp 1078-1080

DIANOV, Ye. M., KARASIK, A. Ya., MAMYSHEV, P. V., ONISHCHUKOV, G. I., PROKHOROV, A. M., STEL'MAKH, M. F. and FOMICHEV, A. A., Institute of General Physics, USSR Academy of Sciences, Moscow Physical-Technical Institute

[Abstract] Fifteen-fold compression of 60-ps pulses from a YAG:Nd^{3+} laser is described. Supershort pulses 60 ps long are obtained by mode locking at twice the inter-mode beat frequency employing preliminary free lasing for approximately 300 μs. The maximum compression in the experiments was limited by the occurrence of stimulated Raman scattering. Compression efficiency can be increased by raising the Raman scattering threshold, either by introducing selected losses in the single-mode fiber optic light guies on the Stokes frequency, or by using a light guide whose length exceeds the length of the coherent interaction between the stimulated Raman scattering pulses and pumping pulses. Figures 2, references 6: 1 Russian, 5 Western.
[400-6900]

UDC 621.373.826.038.823

PHOTODISSOCIATION XeF-LASER WITH APPROXIMATE EFFICIENCY OF 1%

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 11, No 6, Jun 84
(manuscript received 6 Mar 84) pp 1080-1081

ZUYEV, V. S., MIKHEYEV, L. D. and STRAVROVSKIY, D. B., Physics Institute imeni P. N. Lebedev, USSR Academy of Sciences

[Abstract] Experiments are conducted to determine the efficiency of a photodissociation XeF-laser employing XUV open strong-current discharge pumping. The efficiency at the strongest part of the lasing pulse was 0.8% at 353 nm and 1% at 485 nm. Lasing pulse energy at 28 J and average energy output of 18 J/l is obtained at 350 nm, with respective figures of 14.5 J and 10 J/l at 485 nm. It is determined analytically that the efficiency can be increased to approximately 2% by increasing the pressure of the buffer gases and improving the performance of the cavity.
References 4 Russian.
[400-6900]

UDC 621.373.826.038.823

DUAL-MODE GAS LASERS AND THEIR APPLICATIONS IN SPECTROSCOPY AND OPTICAL FREQUENCY STANDARDS (REVIEW)

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 11, No 6, Jun 84
(manuscript received 28 Nov 83) pp 1084-1105

BASOV, N. G., GUBIN, M. A., NIKITIN, V. V. and PROTSENKO, Ye. D., Physics Institute imeni P. N. Lebedev, USSR Academy of Sciences

[Abstract] Research on gas lasers (mainly helium and neodymium) showing dual-mode operation as promising for spectroscopic and other applications was summarized. The basic characteristics of dual-mode operation are presented, and methods for experimental realization in various lasers are discussed. The spectroscopic applications of dual mode operation for high sensitivity extraction of narrow saturated absorption resonances and disperison employing dual model operation in lasers with an internal absorbing cell are demonstrated. The sensitivities of different saturation spectroscopy methods are compared. The status and prospects for research on dual mode lasers at optical frequency standards are discussed. Figures 20, references 59: 48 Russian, 11 Western.
[400-6900]

UDC 621.373.826:533

ACCELERATION OF ELECTRONS FORMED DURING FOCUSING OF LASER RADIATION IN GAS

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 11, No 6, Jun 84
(manuscript received 2 Jun 83) pp 1123-1128

ARSLANBEKOV, T. U., MESRIN, O. A., MIKHAYLOVA, T. I., PAZDZERSKIY, V. A., and KHABIBULLAYEV, P. K., Department of Thermal Physics, Uzbek SSR Academy of Sciences

[Abstract] The integral energy distribution function of electrons formed when laser radiation is focused into a gas and accelerated by gradient forces is computed. Models of spherical and cylindrical focal symmetry with a Debye radius much larger than the focusing region are examined. The calculated integral distribution functions are compared with experimental findings, demonstrating qualitative agreement. The concept of gradient forces in a rarefied plasma makes it possible to explain qualitatively the experimentally observed energy spectra of electrons formed when intense laser radiation is focused into a gas. Figure 1, references 14: 9 Russian, 5 Western.
[400-6900]

UDC 621.373.826.038.823

REMOVAL OF MATERIAL FROM HARD TARGET DURING COMBINED INTERACTION OF TWO LASER PULSES WITH DIFFERENT DURATIONS

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 11, No 6, Jun 84
(manuscript received 30 Aug 83) pp 1220-1224

ARUTYANYAN, R. V., BARANOV, V. Yu., BOL'SHOV, L. A., GORLENKOV, A. N., DOLGOV, V. A. and MEZHEVOV, V. S.

[Abstract] The removal of melted solid material from the surface crater using a laser pulse having its heat in the tail is investigated. The pulse is formed by aiming a long low-intensity pulse at the target, causing material to melt, followed by a short pulse with intensity exceeding the threshold of developed evaporation sufficient to remove the melted material from the crater. The hydrodynamics of melting under the influence of the forces exerted by the vapor pressure is analyzed. The theoretical and experimental findings indicate that the combined operation of pulses with different lengths, or of a complex pulse, is promising for machining, such as laser drilling of metals. Figures 4, references 15: 7 Russian, 8 Western.
[400-6900]

UDC 621.373.826.038.823

RF-EXCITED HIGH STABILITY COMPACT CO_2-LASER

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 11, No 6, Jun 84
(manuscript received 7 Sep 83) pp 1236-1241

MIRZAYEV, A. T. and SHARAKHIMOV, M. Sh., Tashkent State University

[Abstract] A miniature high stability CO_2 RF laser is developed that has lower working voltage than analogous DC discharge lasers and that exhibits lower radiation noise. The factors determining power and frequency instability are investigated in detail. It is found that the experimental CO_2 RF laser suffers from fluctuations in radiated power due to variation in the length of the cavity and the amplitude of the RF field. Cavity instability is the dominant factor underlying substantial modulation of the laser power. Frequency stabilization by means of externally-modulated automatic frequency control at 850 Hz is described. Figures 6, references 8: 5 Russian, 3 Western.
[400-6900]

UDC 621.37.833

INVESTIGATION OF ACTIVE MEDIUM OF CLOSED-CYCLE CO_2 LASER

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 2, Feb 84 (manuscript received 23 Jun 82) pp 8-10

KUPRENYUK, V. I., KLIMENT'YEV, S. I., MARUSYAK, N. V., SERGEYEV, V. V., SMIRNOVA, L. D. and SHEKHTMAN, V. N.

[Abstract] The findings from an investigation of the active medium employed in a closed-cycle CO_2 process laser are presented. The optical homogeneity and cross-sectional gain distribution of the active medium are investigated. The resultant information can be used to calculate the optimal useful loss of a laser cavity and to select its dimensions and cross-sectional shape so as to make maximum use of the excitation energy with minimum influence of optical distortions in the active medium on the quality of the radiation generated. Figures 4, references 4 Russian.
[314-6900]

UDC 621.327:621.373.826

SAPPHIRE K-Rb LAMP - AN EFFICIENT YAG:Nd CW LASER PUMPING SOURCE

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 3, Mar 84 (manuscript received 20 May 83) pp 42-46

GAYDUKOV, Ye. N,, KROMSKIY, G. I., LEONOV, G. S. and SPARYKIN, L. G.

[Abstract] The paper gives basic specifications and operating characteristics of sapphire-envelope pumping lamps employing an arc discharge in K+Rb vapors that provide a two-fold gain in power over krypton arc lamps. The construction of the lamp and manufacturing methods are described. The spectral power characteristics and operating characteristics of the lamp are analyzed, and a functional diagram of the power source employed is presented. Increasing service life throughout the range of working power and expanding the range of working powers is the subject of further research. Figures 4, references 6: 5 Russian, 1 Western.
[351-6900]

ELECTRIC-DISCHARGE IONIZATION LASER ON METASTABLE XENON ATOMS

Moscow PIS'MA V ZHURNAL EKSPERIMENTAL'NOY I TEORETICHESKOY FIZIKI in Russian
Vol 39, No 9, 10 May 84 (manuscript received 20 Mar 84) pp 426-428

BARANOV, V. V., BASOV, N. G., DANILYCHEV, V. A., DUDIN, A. Yu., ZAYARNYY, D. A., USTINOVSKIY, N. N., KHOLIN, I. V. and CHUGUNOV, A. Yu., Institute of Physics imeni P. N. Lebedev, USSR Academy of Sciences

[Abstract] An experiment was performed to establish the feasibility of producing a gas laser on metastable Xe atoms by pumping with an external electric-discharge source so as to attain higher power and quantum efficiency than those of He-Ne lasers with self-maintained electric-discharge pumping. A beam of fast electrons from a quasi-steady nonself-maintained ionizing source was made to excite Xe atoms from the metastable 6s state into 5d-6p transitions, excitation of higher-level states ensuring not only a high quantum efficiency but also a low sensitivity to instabilities. A 300 keV electron beam of 10x100 cm^2 cross section was injected transversely, in pulses of 3.5 μs duration, into a cell containing 10 dm^3 of an Ar:Xe=100:1 mixture under a pressure of 3.5 atm as active medium, after first passing through a 20 μm thick titanium foil. Periodic discharge was produced by a capacitor bank, the first period of the discharge current being approximately equal to the pulse duration of the electron beam. The laser resonator was formed by a plane gold mirror and a stack of two quartz plates. Lasing was observed at five 5d-6p transitions, more than 90% of the energy being emitted at the λ=1.73 μm wavelength, in accordance with the corresponding ionization and recombination reactions. A maximum output energy higher than 50 J with a 3% efficiency of electric-discharge pumping was attained at an approximately 20% quantum efficiency and 5% physical efficiency. Figures 2, references 6: 2 Russian, 4 Western.
[330-2415]

SELECTIVE LASER CONTROL OF ELECTROCHEMICAL PROCESSES

Moscow PIS'MA V ZHURNAL EKSPERIMENTAL'NOY I TEORETICHESKOY FIZIKI in Russian
Vol 39, No 10, 25 May 84 (manuscript received 5 Apr 84) pp 464-466

BUNKIN, F. V., LUK'YANCHUK, B. S. and SHAFEYEV, G. A., Institute of General Physics, USSR Academy of Sciences

[Abstract] The role of thermal diffusion processes occurring during selective absorption of laser radiation by electrolyte ions is investigated. Experiments conducted with YAG:Nd^{3+} CW laser (λ=1.06 μm) were conducted to study the occurrence of convective movement. It was found that the mass of both electrodes decreases, with that of the "cold" (far) electrode dropping off twice as fast. The magnetic fields induced by the currents in the electrolyte with and without electrodes were recorded. It is shown that laser radiation can be used for selective control of electrochemical

processes, especially for accelerating (or retarding) the precipitation of a given type of ions on an electrode. Acceleration of a required reaction channel comes about as the result of thermal diffusion of absorbing ions in the laser radiation field. Figures 2, references 3 Russian. [388-6900]

UDC 621.373:535

YAG-Nd CW LASER WITH PASSIVE SELF-MODE LOCKING STABILIZATION (PART I)

Leningrad OPTIKA I SPEKTROSKOPIYA in Russian Vol 55, No 5, Nov 83 (manuscript received 4 Feb 82) pp 928-934

GUSEV, A. A., KRUZHALOV, S. V., L'VOV, B. V., PAKHOMOV, L. N., and PETRUN'KIN, V. Yu.

[Abstract] The problem of stabilizing self-mode locking of continuously pumped YAG-Nd lasers is solved by using an external passive YAG-Nd element. The method is examined theoretically and interpreted physically. The results of a detailed experimental investigation are presented. It is found that the use of a passive element stabilizes the relative phase angle by reducing the dispersion and its values, which is equivalent to stabilizing the temporal form of the radiation. Figures 3, references 5: 4 Russian, 1 Western. [313-6900]

UDC 621.373:535

METHOD FOR SELF-CONSISTENT ANALYSIS OF LASER PUMPING SYSTEMS. 1. MATHEMATICAL MODEL OF PUMPING SYSTEMS WITH HETEROGENEOUS TEMPERATURE FIELD IN LAMP DISCHARGE

Leningrad OPTIKA I SPEKTROSKOPIYA in Russian Vol 56, No 3, Mar 84 (manuscript received 14 Jul 81) pp 490-496

GRADOV, V. M., MAK, A. A., SHCHERBAKOV, A. A. and YAKOVLEV, A. V.

[Abstract] A self-consistent method for modeling pumping systems is developed for the case of irregular temperature distribution in the lamp plasma. The processes underlying the transfer of radiation in absorbing or amplifying heterogeneous media is described exactly on the basis of the concept of a photon of variable energy weight. A system of equations is derived to describe the discharge loop, the discharge and the transfer of radiation in the plasma and in all of the media of a pumping system of arbitrary geometry. The method is tested by comparing the analytical results and experimental findings for an air-cooled ruby laser. The method describes the energy characteristics of the laser radiations adequately, allowing the software to be used for reliable prediction of the power profile of laser systems employing optically dense discharges. Figures 3, references 9 Russian. [389-6900]

UDC 621.373:535(206.1)

YAG-Nd CW LASER WITH PASSIVE SELF-MODE LOCKING STABILIZATION (PART II)

Leningrad OPTIKA I SPEKTROSKOPIYA in Russian Vol 56, No 4, Aug 84 (manuscript received 24 May 82) pp 708-711

GUSEV, A. A., KRUZHALOV, S. V., L'VOV, B. V., PAKHOMOV, L. N. and PETRUN'KIN, V. Yu.

[Abstract] The influence of a passive intracavity YAG-Nd element on the self-mode locking in a YAG laser is investigated experimentally. The proposed method for passive stabilization of self-mode locking in CW YAG lasers is found to be highly effective. The use of a passive intracavity YAG element makes it possible to obtain powerful radiation with a broad range of adjustment of the repetition frequency of the output pulses extended to a maximum of 1.6 GHz. The resulting regime is shown to be highly resistant to various types of perturbing factors, and is comparable to the stability provided by automatic stabilization systems. Figures 4, references 2 Russian.
[315-6900]

CATHODE LUMINESCENCE $R_0$6G LASER

Leningrad PIS'MA V ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 10, No 9, 12 May 84 (manuscript received 10 Jan 84) pp 559-561

LISITSYN, V. M., LYAKH, G. O., ORLOVSKIY, V. M., OSIPOV, V. V. and URBAZAYEV, M. N.

[Abstract] The use of cathode luminescence of semiconductor crystals for pumping dye lasers is proposed in order to obtain lasing over a broad spectral interval of the visible band. The experimental setup is described, and the energy spectrum of the beam electrons measured with the help of a Faraday cylinder is plotted. The shpae of the laser radiation pulse is found to be close to that of the pumping pulse because of the short cathode luminescence attenuation time. The findings indicate that cathode luminescent pumping of organic dyes to create powerful high efficiency tunable lasers is promising. Figures 2, references 4 Russian.
[397-6900]

EMPLOYMENT OF INCOHERENT PUMPING IN FREE-ELECTRON LASERS

Leningrad PIS'MA V ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 10, No 10, 26 May 84 (manuscript received 27 Jan 84) pp 584-588

GINZBURG, N. S., Institute of Applied Physics, USSR Academy of Sciences

[Abstract] Incoherent pumping in an amplifier version of a free-electron laser is investigated for a signal field consisting of a monochromatic wave and a pumping field consisting of a series of discrete lines with uncorrelated phases. A formula describing the averaged movement of relativistic electrons in the signal and pumping fields is derived. Expanding the pumping spectra in free electron ubitrons with irregular undulators in which the distance between the magnets is random in order to increase efficiency is examined and found to be promising for direct-acting high-current accelerator injectors. Figure 1, references 7: 5 Russian, 2 Western.
[402-6900]

ELECTRON-BEAM EXCITATION OF LEAD-VAPOR LASER

Leningrad PIS'MA V ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 10, No 10, 26 May 84 (manuscript received 21 Dec 83) pp 620-623

BOKHAN, P. A. and SOROKIN, A. R., Institute of Thermal Physics, Siberian Department, USSR Academy of Sciences

[Abstract] Electron-beam pumping of self-terminating lead vapor lasers operating at a wavelength of 7.229 mm are investigated. The optimum pulse repetition frequency is determined as a function of the delay between the specific lasing energy pulses, and is found to be two orders of magnitude higher for the beam laser than for a gas discharge laser. The findings substantiate the possibility of increasing the efficiency and power of self-terminating metal vapor lasers excited by electron beams. Figures 2, references 12 Russian.
[402-6900]

UDC 533.72:621.378.33

ALLOWANCE FOR INFLUENCE OF ATOM COLLISIONS ON LASING THRESHOLD

Moscow VESTNIK MOSKOVSKOGO UNIVERSITETA: SERIYA 3 FIZIKA, ASTRONOMIYA
in Russian Vol 25, No 2, Mar-Apr 84 (manuscript received 27 May 83) pp 5-11

KLIVADENKO, V. A., Department of General Physics and Wave Processes

[Abstract] The establishment of lasing is investigated with consideration of the influence of collisions of atoms on the broadening of the spectral lines of the radiation. A two-level model of the atoms of the working medium is examined. A model of strong collisions is examined in which it is assumed that the velocity of the atoms after a collision is determined completely by an equilibrium Maxwell distribution function, and is independent of the velocity of the atom prior to the collision. The use of a wave equation to find the field amplitude and lasing frequency is demonstrated. It is determined that atom collisions result in reduction of the amplitude of the generated field. A weak collision model is examined that described scattering of particles through small angles, such as the scattering of heavy radiating atoms on light perturbing particles. It is assumed within the framework of the approximations employed that allowance for collisions of the atoms of the active medium elevates the threshold population difference for both collision models. References 6 Russian.
[398-6900]

UDC 621.375.8

IMPROVING EFFICIENCY OF NEODYMIUM PHOSPHATE GLASS LASERS BY USING REFLECTORS DOPED WITH OXIDES OF RARE EARTH ELEMENTS

Minsk ZHURNAL PRIKLADNOY SPEKTROSKOPII in Russian Vol 40, No 5, May 84
(manuscript received 26 Oct 82) pp 746-750

YESHMEMET'YEVA, Ye. V., IVANUSHKINA, A. V., KORNEV, V. V., KOROLEV, V. I., PAVLOVA, I. A., POPOVA, L. G., SEDOV, B. M. and KHALILOV, V. Kh.

[Abstract] The authors consider the possibility of improving the efficiency of neodymium glass lasers by absorbing and then converting the ultraviolet portion of the spectrum of the radiation from the pumping lamp by the reflector material. Experiments are described in which the laser efficiency is studied as a function of the electrical energy stored in the storage capacitor. The ultraviolet portion of the spectrum of the lamp is shown to have a negative effect on laser efficiency. The use of reflectors made of materials containing oxides of cesium and europium makes it possible to relieve the active element of the laser in terms of heat without using liquid light filters, and to increase efficiency by virtue of the luminescent properties of the reflector material by a factor of approximately 1.3. Figures 4, references 9: 8 Russian, 1 Western.
[342-6900]

UDC 621.375

POSSIBILITIES OF IMPROVING EFFICIENCY OF LiF:F_2^- CRYSTAL LASERS B IMPROVING RADIATION COLORING TECHNOLOGY

Minsk ZHURNAL PRIKLADNOY SPEKTROSKOPII in Russian Vol 40, No 5, M 84 (manuscript received 15 Oct 82) pp 750-754

MIKHNOV, S. A., RAKUSH, V. V., KHYUPPENEN, V. P., and ASAYENOK, N A.

[Abstract] The efficiency of frequency-tunable lasers is investi ted as a function of the index of residual attenuation of an LiF crystal w h F_2^- color centers. A formula is derived that describes the specific eful oscillating power, i.e., the power generated per unit volume of a ive body. The applicability of the expressions derived for determining the tential possibilities of improving the efficiency of LiF:F_2^- lasers is ch ked for crystals with different values of δ. The experimental result agree well with the theoretical findings. The absolute efficiencies for spe mens with δ=0.04 and 0.16 were 0.45 and 0.25 for pumping energy of 0,2 and pulse length of 12 nsec. Figures 2, references 6 Russian.
[342-6900]

UDC 538.561.

EFFECT OF STIMULATED ELECTROMAGNETIC RADIATION BY LASER IN SOLID DIES

Leningrad ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 54, No 4, A 84 (manuscript received 10 Aug 82; revised 19 Apr 83) pp 808-810

AREF'YEV, K. P., VOROB'YEV, S. A., KUZNETSOV, M. F., MASTOV, Sh. and POGREVNYAK, A. D., Tomsk Polytechnical Institute

[Abstract] A new effect of generation of electromagnetic pulses solid bodies exposed to laser radiation is observed experimentally. Th generation effect is characterized by a pronounced threshold relationship wi the radiation power density that differs for each type of material, pulsed ruby laser operating at λ=694.36 nm is employed. The specimens w e single crystals of Si, Ga, As, KCl and LiF and plates of Cu and Al metal oly- crystals, as well as different rocks: calcides, marble, natural artz and feldspar. Electromagnetic pulses are observed after the material as been struck by a laser pulse. The findings indicate that each materia has a particular threshold with respect to laser power density at which electro- magnetic radiation pulses begin to be generated. The pulse ampli de in- creases almost linearly as the power density up to the point of c plete mechanical destruction of the specimens. It is suggested that th mechanism of stimulated emission may involve two processes that occur with ser action on solids: 1. a change in the distribution of charges tha arise on the edges of developing cracks in the laser-damaged material, res ting in the

high-frequency component of the generated pulses; 2. relaxation of the charged region of the laser-induced crater due to surface and ambient conductivity, leading to a low-frequency component. References 4: 2 Russian, 2 Western. [319-6900]

UDC 537.321

INVESTIGATIONS OF CONDITIONS FOR OCCURRENCE OF LASER-INDUCED SPARK

Leningrad ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 54, No 6, Jun 84 (manuscript received 1 Jun 83) pp 1095-1100

ZAKHARCHENKO, S. V., SINMYURIN, G. A. and SKRIPKIN, A. M., Institute of Experimental Meteorology

[Abstract] The occurrence of elongated laser sparking and the influence of solid aerosol particles in the air on the sparking process are investigated experimentally. A Q-switched laser employing neodymium-activated glass operating at a wavelength of 1.06 μm is used. The appearance of the elongated laser sparks is recorded photographically. The concentration of aerosol particles is varied widely. The experiments indicate that the spark concentration (number of sparks per unit length) for a fixed radiation energy initiating the spark increases as the concentration of aerosol particles in the air increases, and also varies as a function of the size distribution of the particles. The findings agree well with the hypothesis regarding the aerosol nature of elongated laser sparking. Figures 5, references 16: 11 Russian, 5 Western.
[387-6900]

UDC 539.12.04+539.12.074+539.143.2:243.51

CONTRIBUTION OF NUCLEAR INTERACTIONS TO DISTRIBUTION OF ABSORBED ENERGY FROM FAST CHARGED PARTICLES IN THIN PLATES

Moscow ATOMNAYA ENERGIYA in Russian Vol 56, No 6, Jun 84
(manuscript received 14 Oct 83) pp 413-415

ANDREYEV, S. G., DMITRIYEVSKIY, I. M. and KHVOSTUNOV, I. K.

[Abstract] The problem of absorbed energy distribution with allowance for ionization and nuclear interactions in the absorber is examined for the case of a layer in a vacuum. An equation is derived for estimating "nuclear" effects that allows for the finite probability of nuclear interactions of particles. It is found that the distribution of absorbed energy differs significantly from the fast-particle energy loss distribution in the layer considering elastic scattering by nuclei because of the high probability that scattered protons will be ejected from the layer. The difference between the absorbed energy and energy loss distributions due to ejection of secondary particles from within the material indicates correlation of the energy release processes in adjacent layers, which probably must be taken into account when processing the results of measurements in multilayer ionization detectors. Figure 1, references 9 Russian.
[403-6900]

DETERMINATION OF MASS DIFFERENCE BETWEEN TRITIUM AND HELIUM-3 BY METHOD OF ION CYCLOTRON RESONANCE

Moscow PIS'MA V ZHURNAL EKSPERIMENTAL'NOY I TEORETICHESKOY FIZIKI in Russian Vol 39, No 9, 10 May 84 (manuscript received 9 Feb 84) pp 441-443

NIKOLAYEV, Ye. N., NERONOV, Yu. I., GORSHKOV, M. V. and TAL-ROZE, V. L., Institute of Chemical Physics, USSR Academy of Sciences

[Abstract] The mass difference between tritium and helium-3, indicating the quiescent mass of a neutrino, was determined by the method of ion cyclotron resonance with Fourier transformation. Ions were whirled in a magnetic field by a radio-frequency pulse and the induced cyclotron signal picked off capacitor plates. The mass-spectrometer was built on the basis of a CMS-47 "Spectrospin" instrument, with special auxiliary radioelectronic equipment for measuring masses smaller than 12 atomic units. A mixture of $^3He:T_2=1:100$ was injected into a high-vacuum chamber, with the pressure within the $(5.5-8.0)^{-9}$ torr range monitored by an ionization-type manometer which had been calibrated against nitrogen. The mixture was ionized with 50-96 eV electrons in 35-70 μs excitation pulses. A series of 6 measurements yielded a total of 142 Fourier spectra. Their analysis yielded a mass difference of 18,573 eV with a standard deviation of 4 eV, taking into account known systematic errors of this method. The authors thank Yu. V. Tarbeyev for collaboration and N. F. Myasoyedov for supplying specimens with low tritium content. Figure 1, table 1, references 7: 3 Russian, 4 Western.
[330-2415]

UDC 534.222.2

STIMULATED RAMAN SCATTERING OF LIGHT ON BUBBLES CONSIDERING CUBIC NONLINEARITY

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 30, No 3, May-Jun 84 (manuscript received 17 Dec 82) pp 324-327

ZABOLOTSKAYA, Ye. A., Physics Institute, imeni P. N. Lebedev, USSR Academy of Sciences

[Abstract] Stimulated Raman scattering of sound on air bubbles distributed in water is examined theoretically with allowance for cubic nonlinearity. Equations are derived to describe the propagation and interaction of waves in water containing air bubbles. It is found that quadratic nonlinearity of the bubbles due to repeated interactions causes the Stokes wave to grow exponentially. The backscattering is greater than the forward scattering because the parametric interaction of the waves reduces the rise in amplitude of the difference wave. Cubic nonlinearity of the bubbles shifts the natural eigen frequency of the oscillations of the bubbles by an amount proportional to the pumping intensity. References 10 Russian.
[382-6900]

UDC 551.52:551.591

STRATOSPHERIC BALLOON SPECTROSCOPIC INVESTIGATIONS OF ABSORBING GAS CONTENT AND AEROSOL ATTENUATION IN TROPOSPHERE AND STRATOSPHERE

Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA FIZICHESKAYA in Russian Vol 48, No 4, Apr 84 pp 727-731

KISELEVA, M. S.

[Abstract] Spectroscopic investigations of the atmosphere performed from stratospheric balloons are reviewed. Solar spectra are recorded at different altitudes by the setting sun method. The application of the generalized argument method to stratospheric balloon measurements of setting sun spectra has yielded new data on the optical properties of the atmosphere in the

0.4-12.0 μm region below 30 km. A number of examples are cited that demonstrate the validity of stratospheric balloon spectral investigations in atmospheric optics. References 19: 12 Russian, 7 Western.
[335-6900]

UDC 543.42

LASER PHOTOIONIZATION METHOD FOR IDENTIFYING TRACES OF ELEMENTS IN MATTER

Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA FIZICHESKAYA in Russian Vol 48, No 4, Apr 84 pp 771-777

BEKOV, G. I. and RADAYEV, V. N.

[Abstract] Traditional analytical methods for identifying minute traces of elements in different substances are reviewed. A laser photoionization analytical spectrometer is described that employs a step photoionization method in which the atoms are excited by laser radiation to an intermediate energy state, after which only the excited atoms are photoionized. The most versatile method for ionizing atoms to detect them is found to be selective excitation of atoms to Rydberg states followed by ionization with an electrical field. Examples of laser atom-photoionization analysis performed on an experimental setup are described. Results of laser atom-photoionization determination of element traces in different substances are tabulated. References 15: 10 Russian, 5 Western.
[335-6900]

UDC 543.42

EMISSION SPECTRAL ANALYSIS OF GASES: STATUS, PROBLEMS AND PROSPECTS FOR DEVELOPMENT

Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA FIZICHESKAYA in Russian Vol 48, No 4, Apr 84 pp 785-788

BOL'SHAKOV, A. A., NEMETS, V. M., OSHEMKOV, S. V., PETROV, A. A. and SOLOV'YEV, A. A.

[Abstract] The development of emission spectral gas analysis over the past several years is traced. Recent findings indicate that the spectrum analytical methods can profitably be combined with gas adsorption chromatography and cryogenic accumulation of admixtures on different types of sorbents. Emission spectral analysis is becoming more versatile, and its determination thresholds continue to drop. However, certain methods are encountering difficulties in solving problems of correct identifications and of metrological support. Resonant excitation of the analytical spectrum - fluorescent analysis

methods - have been developed recently, whose prospects are improved by the use of lasers. Methods based on nonresonant excitation of emission spectra are reviewed. The emission spectral analysis methods reviewed provide major capabilities for gas analysis in production as well as scientific research problems. References 11 Russian.
[335-6900]

UDC 621.375.826:543.42

METHODS AND MEANS FOR LASER SPECTROSCOPY OF MOLECULES IN VISIBLE AND NEAR INFRARED BANDS

Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA FIZICHESKIYA in Russian Vol 48, No 4, Apr 84 pp 802-809

ZUYEV, V. Ye., LOPASOV, V. P. and YAKOVLEV, N. Ye., Institute of Atmospheric Optics, Siberian Department, USSR Academy of Sciences

[Abstract] The results of developing and testing methods and laser equipment for measuring harmonic spectra and composite oscillating frequencies using tunable lasers are presented. The spectrophotometric method of measuring radiation frequency is explained. A system for automating spectroscopic measurements based on an SM-3 minicomputer is presented. An acoustooptical spectrometer is described that generates acoustic oscillations in a gas that absorbs pumping energy modulated at the acoustic frequency. An intracavity laser spectroscopy method is described. The devices developed can be used to record and investigate weak short-wave molecule absorption bands, and the use of different dyes and color centers in the lasers makes it possible to cover the entire 8000 - 25,000 cm^{-1} band. References 8 Russian.
[335-6900]

UDC 621.378.325

COMPENSATION FOR NONLINEAR DISTORTIONS OF OPTICAL RADIATION

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 11, No 4, Apr 84 (manuscript received 6 May 83) pp 693-700

KARAMZIN, Yu. N., SUKHORUKOV, A. P. and TROFIMOV, V. A., Moscow State University imeni M. V. Lomonosov

[Abstract] The operating modes of adaptive systems are analyzed for the case in which the maximum deviation of a flexible mirror from the equilibrium position is limited and for additional conditions on the degree of deformation. The effectiveness of nonlinear distortion compensation is estimated quantitatively. Discrete control of beam focusing to compensate for the Kerr

effect and for temperature effects is analyzed. Numerical experiments on controlling the wavefront of the light beam discretely are described. Figures 3, references 12: 9 Russian, 3 Western.
[332-6900]

UDC 621.378.9:535.82

INTERACTION OF LIGHT BEAMS IN ACTIVE MEDIUM OF COPPER-VAPOR BRIGHTNESS AMPLIFIER

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 11, No 5, May 84 (manuscript received 23 Jun 83) pp 932-936

KAZARYAN, M. A., MATVEYEV, V. M. and PETRASH, G. G., Physics Institute imeni P. N. Lebedev, USSR Academy of Sciences

[Abstract] The introduction of light beams in the active medium of a copper-vapor amplifier is investigated with the use of an experimental setup employing a self-contained illumination source consisting of a pulsed copper-vapor laser with the optical circuit modified somewhat in order to change the geometry of the intersection of the two beams. The ratio of the powers of the interacting beams is maintained during amplification in the experiments, in contrast to independent beam propagation during which the output power densities can be comparable because of the saturation effect. This suggests that the contrast of images constructed at infinity and transmitted by means of a copper vapor brightness amplifier will be as good as that of the original over a wide range of power of the interacting beams. The effects observed can be used to create a nanosecond light-controlled optical shutter. Figures 5, references 6 Russian.
[386-6900]

UDC 538.574.4

INTENSITY FLUCTUATION DURING FOCUSING OF REFLECTED LIGHT IN TURBULENT ATMOSPHERE

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 11, No 5, May 84 (manuscript received 8 Jul 83) pp 1022-1026

AKSENOV, V. P., BANAKH, V. A., BULDAKOV, V. M., MIRONOV, V. L. and TIKHOMIROVA, O. V., Institute of Atmospheric Optics, Siberian Department, USSR Academy of Sciences

[Abstract] Fluctuations in the intensity of reflected waves passing twice through the same turbulent heterogeneities and reaching the focal plane of the receiving telescope are investigated. It is found that focusing of a plane wave reflected in a turbulent medium increases the dispersion

of the intensity uctuations of the reflected wave as compared with the dispersion in the perture plane of a telescope. The saturation level of the relative disp sion of the fluctuation for a wave scattered on a regular object increases om a value of 3 in the plane of the receiving aperture to 5 at the focus f the telescope; the same figure varies from 7 to 11 for a wave scattered an object with random reflecting properties. References 16 Rus an.
[386-6900]

UDC 621.375.826

SWITCHING WAVES I THERMAL OPTICALLY NONLINEAR MULTISTABLE FABRY-PEROT INTERFEROMETER

Moscow KVANTOVAYA LEKTRONIKA in Russian Vol 11, No 5, May 84
(manuscript recei d 1 Aug 83) pp 1060-1065

GRIGOR'YANTS, A. , GOLIK, L. L., RZHANOV, Yu. A., YELINSON, M. I. and BALKAREY, Yu. I.

[Abstract] The c racteristics of switching waves in a thermal optically nonlinear interfe meter caused by multistability are investigated numerically and experimentall It is shown that the velocity spectrum of singular waves changes qua tatively as the external parameters vary. The propagation interaction of sw ching waves of different amplitude is investigated. It is found that mul stability in a nonlinear distributed interferometer leads to the possible e stence of different types of switching waves. These waves can be used for s ce modulation of the laser radiation, as well as for modeling analogou processes in chemical-biological and other systems. Figures 7, refere es 16: 10 Russian, 6 Western.
[386-6900]

UDC 535.375.5.01

SEMIEMPIRICAL THE Y OF FIRST-ORDER RAMAN LIGHT SCATTERING IN EXTERNAL ELECTRICAL FIELD

Leningrad OPTIKA SPEKTROSKOPIYA in Russian Vol 56, No 3, Mar 84
(manuscript recei d 2 Jul 82) pp 430-434

BABUSHKIN, A. N., HEREPANOV, V. I. and MAL'TSEV, V. N.

[Abstract] A mic scopic (semiempirical) theory of the influence of an external electric field on the intensity of first-order Raman scattering lines for crystal of arbitrary symmetry and structure is examined. The theory is semiempirical that the final result used to estimate the scattering

intensity is expressed through electrooptical effect constants. The constants of the quadratic as well as linear electrooptical effect are in general non-zero, which distinguishes the statement from other approaches. The relative strength of the effect in lead germanate $Pb_2Ge_3O_{11}$ is estimated using experimentally measured electrooptical constants. The types of incident and scattered light polarization and external field direction for which the ignition of forbidden lines can be expected are identified. Expressions are derived for the polarizability of the crystal in an electric field, and selection rules are formulated for first-order Raman scattering.
References 8 Western.
[389-6900]

UDC 535.317.1

HOLOGRAM RECONSTRUCTION OF ABERRATION-FREE FRONT

Leningrad OPTIKA I SPEKTROSKOPIYA in Russian Vol 56, No 3, Mar 84
(manuscript received 7 Jun 82) pp 541-544

MIKHAYLOV, I. A.

[Abstract] The use of holographic optical elements to replace expensive complicated optics used to form an aberration-free light wavefront in interferometric research, quality control of optical parts, etc. is described. Simultaneous compensation of all third- and fifth-order monochromatic aberrations in the image of a point source reconstructed by the hologram is examined. The method is demonstrated by a numerical example. The results can be used to optimize the recording and reconstruction arrangements of holographic optical elements. Figure 1, references 2: 1 Russian, 1 Western.
[389-6900]

UDC 535.2

EXPERIMENTAL OBSERVATION OF SHOCK WAVES OF ENVELOPES OF SUPERSHORT LIGHT PULSES

Leningrad OPTIKA I SPEKTROSKOPIYA in Russian Vol 56, No 4, Apr 84
(manuscript received 25 Oct 83) pp 577-579

NESTEROVA, Z. V., ALEKSANDROV, I. V. and SOLOV'YEV, V. V.

[Abstract] Shock waves of the envelope of powerful picosecond light pulses are recorded experimentally in capillary fiber optic light guides filled with pure organic compounds and in single-mode quartz fiber optic light guides. Shock waves of the envelopes of powerful light pulses are produced

at the frequencies of a series of stimulated Raman scattering components in capillary fiber optic light guides filled with liquid organic compounds, and at the pumping frequency in a single-mode quartz light guide. The mechanism underlying the spontaneous temporal compression of super-short light pulses in nonlinear media can be viewed as a way for obtaining powerful subpicosecond and femtosecond light pulses. Figures 2, references 8: 2 Russian, 6 Western.
[315-6900]

UDC 535.818.8

ANALYSIS OF SYMMETRIC OPTICAL SYSTEMS EMPLOYING HOLOGRAPHIC LENSES

Leningrad OPTIKA I SPEKTROSKOPIYA in Russian Vol 56, No 4, Apr 84 (manuscript received 28 Sep 81) pp 715-720

SHITOV, V. G.

[Abstract] The possibility of constructing symmetric optical systems employing holographic lenses, which are free of third-order monochromatic aberrations as well as chromatic distortions, is examined. No limit is placed on the number of refracting surfaces contained in the system. An algorithm and formulas are derived that completely define the parameters of a symmetric optical system with a holographic lens in which there is no third-order aberration or chromatism. Figure 1, references 9: 7 Russian, 2 Western.
[315-6900]

UDC 534.522

SPREAD FUNCTION OF ACOUSTOOPTICAL FILTER WITH NON-COLLINEAR INTERACTION

Leningrad OPTIKA I SPEKTROSKOPIYA in Russian Vol 56, No 4, Apr 84 (manuscript received 6 Apr 82) pp 736-739

MAGDICH, L. N., MOLCHANOV, V. Ya. and PONOMAREVA, I. P.

[Abstract] The behavior of the spread function of a non-collinear acousto-optical filter is studied as the frequency of the control signal is varied linearly. The spread function, which is linearly related with the frequency response, is found to be independent of the weight of frequency change of the control signal until the amount of change during the transmission time of the acoustic wave through the light wave is significantly smaller than the bandwidth of the filter which is realized during slow tuning. The filter is fastest with a light beam that is as small as possible in the plane of diffraction. The width of the spread function increases in proportion to the tuning rate as the control signal is tuned rapidly. Shifting of the function

is observed which is associated with the change in frequency of the control signal occurring during the time elapsed while the acoustic wave covers the path from the piezotransducer to the middle of the light beam. Figures 2, references 2: 1 Russian, 1 Western.
[315-6900]

UDC 621.371:538.566

DISPERSION AND SPATIAL CORRELATION OF INTENSITY OF LASER BEAMS REFLECTED IN TURBULENT ATMOSPHERE

Leningrad OPTIKA I SPEKTROSKOPIYA in Russian Vol 56, No 5, May 84 (manuscript received 28 Jul 82) pp 857-863

BANAKH, V. A. and TIKHOMIROVA, O. V.

[Abstract] The relative dispersion and spatial correlation coefficient of the intensity of laser radiation scattered by two types of surfaces - a flat mirror and a trihedral corner reflector - are examined as a function of the diffraction parameters of the incident radiation and the dimensions of the reflector. The analysis employs equations for the statistical moments of the propagator. It is found that the relative back-dispersion of the intensity is independent of the type of reflector, and is smallest when the dimensions of the source and the reflector are comparable to the radius of the first Fresnel zone. The positive correlation for a corner reflector is significantly higher than for mirror reflection, while the negative correlation is lower. It is found that the amplification of intensity fluctuations and the residual correlation level depend strongly upon the diffraction parameters of the incident radiation and the type and size of reflector. Figures 4, references 10 Russian.
[383-6900]

UDC 535.2

OBJECT IMAGE DISPLACEMENT VARIANCE WITH LIDAR IN TURBULENT ATMOSPHERE

Leningrad OPTIKA I SPEKTROSKOPIYA in Russian Vol 56, No 5, May 84 (manuscript received 31 Jan 83) pp 864-868

AKSENOV, V. P., BANAKH, V. A. and CHEN, B. N.

[Abstract] The variance of random displacement of the lidar image of a flat reflecting disk and corner reflector is investigated as a function of the diffraction dimensions of the illumination source, reflector and lens of the receiving telescope in the region of weak intensity fluctuations.

The analysis employs the mutual coherent functions of the second and fourth orders of the complex amplitude of the wave field. The effects of displacement quadrupling, doubling and dispersion, as well as compensation, are found not to occur for a laser source operating in the spherical wave mode. Figures 2, references 10: 8 Russian, 2 Western.
[383-6900]

UDC 621.373:535

MEASUREMENT OF OPTICAL STRENGTH OF RAPIDLY FLUCTUATING HEAT LENSES IN LASER ELEMENTS

Leningrad OPTIKA I SPEKTROSKOPIYA in Russian Vol 56, No 5, May 84 (manuscript received 31 May 83) pp 943-946

LOKHNYGIN, V. D., ROGOVSKIY, O. V., SILICHEV, O. O. and FOMICHEV, A. A.

[Abstract] A method is proposed for measuring the rapidly fluctuating thermooptical distortions known as heat lenses that occur during longitudinal pumping of dye solutions by single-mode radiation from pulsed lasers. The dynamics of the development of heat lenses in a number of media (organic dye solutions) in the nanosecond range is investigated. The method is based on measuring the constriction of a steady-state Gaussian radiation beam according to its attenuation by means of a filament of known thickness placed in the propagation path of the radiation. It is found experimentally that the power of heat lenses in the organic dye solutions employed in lasers can be quite high for moderate absorbed energies. It is also found that the manner in which the induced heat lens varies over time depends strongly upon the parameters of the medium. FFigures 2, references 6: 5 Russian, 1 Western.
[383-6900]

UDC 612.84

SEARCH EFFICIENCY OF TELESCOPE INSTRUMENT

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 2, Feb 84 (manuscript received 16 Mar 83) pp 1-4

TRAVNIKOVA, N. P.

[Abstract] Optical searching for an object in space by discrete scanning is analyzed for the case in which the object has the same probability of being located at any point within the field. Formulas are derived for the number of halts required to detect an object within the angular field of the instrument. Continuous scanning is compared with discrete scanning. It is shown that the detection probability and detection time depend upon the scanning rate which, in turn, depends upon the background contrast and

angular size of the object. The average object search time and search efficiency of a number of different models of binoculars are analyzed and compared. It is determined that devices with small magnification and wide angular fields are as effective for searching as devices with large magnification but small angular fields. The formulas derived can be used to select the optimum scanning system for given observation conditions.
References 8: 7 Russian, 1 Western.
[314-6900]

UDC 535.361

ANGULAR DISTRIBUTION AND ATTENUATION OF COHERENT LIGHT IN OPAL GLASSES

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 2, Feb 84 (manuscript received 24 Mar 83) pp 16-18

SHCHERBAKOVA, N. I, and VOYSHVILLO, N. A.

[Abstract] The scattering index of transmitted radiation and index of refraction of MS12, MS13, MS19 and MS23 opal glass exposed to radiation from a helium-neon laser and a quartz-halide incandescent lamp with a 0.63-μm interference light filter are investigated in order to study the behavior of the properties of these glasses for coherent and incoherent radiation. The index of refraction of the glasses investigated is found to be independent of the degree of coherence of the illuminating beam.
Figures 2, references 10: 6 Russian, 4 Western.
[314-6900]

UDC 535.87

ESTIMATION OF PARAMETERS OF MULTIELEMENT MIRROR IN ADAPTIVE OPTICAL SYSTEM

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 3, Mar 84 (manuscript received 15 Apr 83) pp 16-18

MALAKHOV, M. N., MATYUKHIN, V. F. and PRILEPSKIY, B. V.

[Abstract] The problem of setting tolerances for the accuracy of the elements of a composite mirror is examined. It is demonstrated possible to calculate the average Strehl number of the multielement aperture as a function of the setting error of said apertures of various configurations. When the number of said apertures $N \geq 12$ the average Strehl number is practically independent of N. Formulas are derived for calculating the average Strehl number of a multielement aperture consisting of circles or regular N-gons.
Figures 3, references 8: 7 Russian, 1 Western.
[351-6900]

UDC 535.242.52

IMPROVING SIGHTING ACCURACY OF AXISYMMETRICAL LUMINOUS OBJECTS

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 3, Mar 84 (manuscript received 8 Jul 83) pp 49-52

KONTIYEVSKIY, Yu. P. and NAZMEYEV, M. M.

[Abstract] The possibility of improving sighting accuracy by exploiting the photometric properties of the eye is examined. An experimental setup is described in which the widths of slits in two screens are compared to determine the placement error of the objects. An experiment is described in which objects are adjusted in relation to one another by comparing the width of lighted slits with angular dimensions ranging from 2 to 80" by visual photometry. The results indicate that the relative error produced by this method is constant, making it possible to achieve good sighting accuracy when the adaptation brightness level is sufficient. The error in sighting luminous axisymmetrical objects is several times smaller than the error of Vernier sighting. References 6: 5 Russian, 1 Western. [351-6900]

UDC 535.612

RECIPROCAL RELATIONS WHEN RADIATION PASSES THROUGH INTERFACE BETWEEN MEDIA WITH DIFFERENT INDICES OF REFRACTION

Moscow TEPLOFIZIKA VYSOKIKH TEMPERATUR in Russian Vol 22, No 2, Mar-Apr 84 (manuscript received 28 Apr 83) pp 405-407

STEPANOV, S. V., Institute of High Temperatures, USSR Academy of Sciences

[Abstract] The relations between the equilibrium intensities in two different media are analyzed. The expressions derived are employed to study the case in which the interface is an ideally smooth surface that reflects radiation according to Fresnel's law. The bidirectional transmission capabilities are analyzed. References 7: 6 Russian, 1 Western. [331-6900]

RESONANCE EFFECTS DURING INTERACTION OF TWO-LEVEL SYSTEM WITH INTENSE POLYCHROMATIC RADIATION

Moscow ZHURNAL EKSPERIMENTAL'NOY I TEORETICHESKOY FIZIKI in Russian Vol 86, No 2, Feb 84 (manuscript received 1 Jun 83) pp 423-433

KOCHAROVSKAYA, O. A., KHANIN, Ya. I. and TSAREGRADSKIY, V. B., Gor'kiy State University imeni N. I. Lobachevskiy, Institute of Applied Physics, USSR Academy of Sciences

[Abstract] Anomalous increases in the spectral brightness of radiation near strong absorption lines of gases within a laser cavity is analyzed for the case of an equidistant mode spectrum with uniform broadening of the unperturbed spectral line of the substance. The conditions for the existence and determination of the position of resonances in the mode absorption coefficients are explained. A group of resonanced is shown to exist whose positions are independent of random mode phases. Resonances in the mode absorption coefficients occur when the inter-mode beat harmonics coincide with the generalized Rabi frequencies, which are functions of the intermode interval, the position of the spectrum of the mode and their intensities. Resonances occur when the field amplitude of each mode considerably exceeds the coherent value and the intermode interval is wider than the spectral line of the substance. Figures 2, references 20: 16 Russian, 4 Western.
[323-6900]

EFFECT OF TRANSVERSE INHOMOGENEITIES ON PROPAGATION OF SIMULTONS (DOUBLE-FREQUENCY LIGHT PULSES) THROUGH THREE-LEVEL MEDIA

Moscow ZHURNAL EKSPERIMENTAL'NOY I TEORETICHESKOY FIZIKI in Russian Vol 86, No 4, Apr 84 (manuscript received 29 Aug 83) pp 1240-1248

BOL'SHOV, L. A., KIRICHENKO, T. K., LIKHANSKIY, V. V., PERSIANTSEV, M. I. and SOKOLOVA, L. K.

[Abstract] Propagation of simultons through three-level media with common ground level (V-configuration) is analyzed for stability against transverse inhomogeneities, in the "soliton" case of equal-strength transition oscillators. The corresponding system of equations for the amplitudes of resonance fields and the amplitudes of levels interacting with a field is reduced to dimensionless form and solved as an eigenvalue problem. The dispersion equation indicates a possibility of "orthogonal" perturbation as well as of exponential instability, the latter involving principally perturbations associated with "proportional" flexure of amplitude and/or phase fronts and degenerating into a 2π-pulse in the single-frequency mode. Analytical results are confirmed by results of a numerical experiment, which suggests that they can be extended to N-frequency simultons in (N+1)-level media. The authors thank A. P. Napartovich for helpful discussions and Yu. V. Orlov, S. P. Rebrik for assistance in processing the numerical data. Figures 5, references 16: 11 Russian, 5 Western.
[337-2415]

UDC 533.9

USE OF GENERALIZED REABSORPTION METHOD TO INVESTIGATE GAS LASER PLASMA

Minsk ZHURNAL PRIKLADNOY SPEKTROSKOPII in Russian Vol 40, No 5, May 84 (manuscript received 10 Jan 83) pp 738-740

VOROB'YEVA, L. P, and MAL'TSEV, A. N,

[Abstract] A specified set of partially reabsorbed lines with common upper or lower levels is employed to investigate gas laser plasma. The initial spontaneous transition scheme is simplified by composing a scheme of four spontaneous transitions that connect two higher levels with two resonances. The use of the method to determine absolute populations and half-width of the spectral lines of the first europium ion is described. Figures 2, references 9 Russian.
[342-6900]

UDC 535.391.4

AMPLIFICATION OF LIGHT DURING REFLECTION FROM HETEROGENEOUS INVERSE DISPERSIVE MEDIUM

Minsk ZHURNAL PRIKLADNOY SPEKTROSKOPII in Russian Vol 40, No 5, May 84 (manuscript received 4 Feb 83) pp 824-828

ZIMIN, A. B, and PETROV, N. S,

[Abstract] The reflection of light by a heterogeneous dispersive inverse medium in the limiting case of smooth heterogeneities or "thick" inverse layers is examined, in which the characteristic length of the heterogeneity for which the index of refraction changes significantly is much greater than the wavelength of the light. In contrast to a semi-infinite homogeneous dispersive medium, the coefficient of reflection in sufficiently thick inverse layers is limited, regardless of gain, due to limitation of the volume of the inverse medium with which the radiation interacts. The limiting case of a semi-infinite homogeneous amplifying medium is possible only for angles of incidence exceeding the limiting value. References 14: 13 Russian, 1 Western.
[342-6900]

UDC 539.194.01

QUANTUM MECHANICAL METHOD FOR CALCULATING FORCE CONSTANTS OF ARBITRARY ELECTRON STATE OF POLYATOMIC MOLECULE

Minsk ZHURNAL PRIKLADNOY SPEKTROSKOPII in Russian Vol 40, No 5, May 84 (manuscript received 30 Oct 82) pp 849-850

RYBKOVA, I. Ye., PRIYUTOV, M. V., KAMENSKIY, Yu. V.

[Abstract] A method is proposed for calculating the force constants of an arbitrary electron state. The proposed method is illustrated by estimating the force constants of the fundamental state of an ethylene molecule. Analysis reveals that the main contribution to the force constant comes from Coulomb interaction of nuclei, with the contribution from vibronic interaction being half as great. The force constants obtained are a zero-order approximation of the force field. References 2 Russian.
[342-6900]

UDC 535.345

THERMAL WAVE POLARIZATION NOISE IN SINGLE-MODE FIBER OPTIC LIGHT GUIDE

Leningrad ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 54, No 4, Apr 84 (manuscript received 15 Jun 83) pp 857-859

POLUKHIN, A. T. and TELEGIN, G. I., Institute of Electrical Engineering and Electronics, USSR Academy of Sciences

[Abstract] Thermal fluctuations of wave polarization in a regular single mode fiber optic light guide are examined. The mean square noise level of the polarization component at the output of the light guide is found as a function of the length of the light guide and the value of the anisotropy parameters as well as the signal averaging time during recording. Stochastic disruption of the polarized oscillations is examined for equilibrium thermal fluctuations. Estimates are made for optimal polarization excitation of the light guide, in which the input polarization of the wave was the same as the intrinsic polarization state of a regular light guide. The noise recorded experimentally was found to be basically thermal in nature. Amplitude noise of the complete signal can be eliminated by subtracting it in a comparison circuit. Figure 1, references 6 Russian.
[319-6900]

UDC 621.385.6

MINIATURIZATION OF DIFFRACTION RADIATION GENERATORS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 277, No 1, Jul 84 (manuscript received 13 Jul 83) pp 84-88

NESTERENKO, A. V., TSVYK, A. I. and SHESTOPALOV, V. P., academician, Ukrainian SSR Academy of Sciences, Institute of Radio Physics and Electronics, Ukrainian SSR Academy of Sciences

[Abstract] Miniaturization of quasioptical diffraction radiation generators is investigated. Experimental findings for generators with short-focus optical resonators having dimensions comparable to the generated wavelength are presented. Miniature diffraction radiation generators are investigated in the millimeter-wave band, indicating that reducing the radii of curvature and aperature of the spherical mirror in the optical resonator increases the starting current of the generator because of the increased size of the interaction space. As the characteristic dimensions of the resonator become smaller, diffraction losses of higher types of oscillations increase. The analysis and experimental findings indicate the possibility of reducing the characteristic dimensions of the open electrodynamic structure of the diffraction radiation generator. The development of miniature open electrodynamic structures expands the function capabilities of the diffraction radiation generator devices and makes it easier to create miniature multistage diffraction electronic devices. References 9: 7 Russian, 2 Western. [412-6900]

UDC 621.373.826.038.825.4

RADIO SIGNAL GENERATION IN LASER-OPTICAL DELAY LINE SYSTEM

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 11, No 4, Apr 84
(manuscript received 10 Jun 83) pp 766-775

GRIGOR'YANTS, V. V., DVORNIKOV, A. A., IL'IN, Yu. B., KONSTANTINOV, V. N., PROKOF'YEV, V. A. and UTKIN, G. M., Institute of Electrical Engineering and Electronics

[Abstract] Self-modulation oscillations in a standard fiber optic communications line formed into a loop are investigated theoretically and experimentally. The light source employed is a semiconductor laser. Formulas are derived to describe the mechanism of single frequency generation of self-modulated sinusoidal radio signals. Conditions for self-sustained oscillation are examined, and the amplitude and frequency of steady-state self-modulation are analyzed. The possibility of stabilizing the frequency of radio oscillations in a laser-optical delay line system was verified on a prototype system with self-modulation in the 30 MHz region. Figures 5, references 6: 3 Russian, 3 Western.
[332-6900]

UDC 621.373.826

SPECKLE-EFFECTS IN ADAPTIVE OPTICAL SYSTEMS

Moscow KVANTOVAYA ELEKTRONIKA in Russian Vol 11, No 6, Jun 84
(manuscript received 15 Jul 83) pp 1128-1137

VORONTSOV, M. A., KARNAUKHOV, V. N., KUZ'MINSKIY, A. L. and SHMAL'GAUZEN, V. I., Moscow State University imeni M. V. Lomonosov

[Abstract] The statistics of a scattered field are analyzed as a function of the structure of the light beam on an object, suggesting a number of new methods for adaptive formation of light fields not requiring point sources. The problem of adaptive focusing of radiation propagating in an optically uniform medium is analyzed. Adaptive formation of light beams on the surface of an extended object through an optically irregular medium, such as the atmosphere, is studied. The aperture probing method for optimization of statistical criteria in adaptive systems is considered. The possibility of adaptation by statistical criteria is investigated experimentally. Efficient control algorithms that account for the statistics of the received signal are recommended for use in adaptive systems operating with strong speckle-modulation of the scattered field. Figures 8, references 27: 18 Russian, 9 Western.
[400-6900]

UDC 519.24

SPATIAL FALSE ALARM DENSITY IN OPTOELECTRONIC SYSTEMS

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 2, Feb 84 (manuscript received 7 Feb 83) pp 4-6

SHKURSKIY, B. I.

[Abstract] Methods are derived for investigating false alarms in optoelectronic systems with respect to random functions of two arguments. Spatial density is employed as the statistical false alarm characteristic. An example is given of the calculation of the spectral density of isotropic gaussian noise at the output of a spatial filter. The spatial false alarm density is tabulated. References 3 Russian.
[314-6900]

UDC 53.089.62

PRECISE MEASUREMENT OF SMALL ANGULAR DEFLECTIONS OF LIGHT BEAM

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 2, Feb 84 (manuscript received 15 Mar 83) pp 45-47

MOLOCHNIKOV, B, I., ANISHCHENKO, L. V. and ZAKIROV, F. F.

[Abstract] The authors consider the possibility of improving the calibration accuracy and certification of small angular deflections by using a rotating optical deflecting wedge that introduces angular deviation of the beam in two planes. The method is tested experimentally on a precision interference-polarization device developed by the authors. It is found that the angular deflections introduced by precisely certified wedges are within approximately 0.2" of those introduced by a roughly certified rotating wedge. It is shown possible to obtain precise angular deflections by using comparatively roughly certified optical waves. Figure 1, references 4 Russian.
[314-6900]

MULTIPLE-MIRROR OPTICAL SYSTEM FOR OBTAINING NEUTRON IMAGE - POSSIBLE PROTOTYPE NEUTRON MICROSCOPE

Moscow PIS'MA V ZHURNAL EKSPERIMENTAL'NOY I TEORETICHESKOY FIZIKI in Russian Vol 39, No 10, 25 May 84 (manuscript received 23 Mar 84) pp 486-488

ARZUMANOV, S. S., MASALOVICH, S. V., STREPETOV, A. N. and FRANK, A. I., Nuclear Energy Institute imeni I. V. Kurchatov

[Abstract] An optical device for obtaining an achromatic neutron image based on using a system of several simple optical components placed at different heights is described. The optical system employs a four-mirror arrangement with two pairs of mirrors, each consisting of a spherical and a flat mirror. The neutron image of the slit is obtained by spatial focusing of ultracold neutrons. The counting rate of the detector is analyzed as a function of the position of the analyzed slit. The results provide an initial demonstration of the possibility of using an achromatic focusing neutron-optical systems with multiple elements to build a neutron microscope with resolution of the order of several μm. Figures 2, references 7: 4 Russian, 3 Western.
[388-6900]

POSSIBILITY OF DEVELOPING WAVEGUIDE OPTICAL PROCESSORS BASED ON CHALCOGENIDE GLASS FILMS

Leningrad PIS'MA V ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 10, No 12, 26 Jun 84 (manuscript received 19 Jan 84) pp 725-730

BYKOVSKIY, Yu. A., BOROLAKIY, Yu. V., MIRONOS, A. V. and SMIRNOV, V. L., Moscow Engineering Physical Institute

[Abstract] The development of waveguide structures for recording waveguide holograms and waveguide hologram modes and recording geometry is discussed. Some properties of the resulting waveguide holograms are studied. Waveguide hologram lenses, serving as the main element in an optical processor, are implemented experimentally. Recording conditions and modes are examined in order to increase diffraction efficiency, and the waveguide parameters are optimized. The use of composite thin-film waveguides and thin-film waveguides based on chalcogenide glass for creating waveguide optical processors is shown to be a promising direction. Figures 2, references 8: 6 Russian, 2 Western.
[391-6900]

UDC 621.313.12:538.4

COMPENSATING FOR PARASITIC HALL CURRENTS IN MHD GENERATOR WITH TEMPERATURE HETEROGENEITY OF PLASMA FLUX

Minsk INZHENERNO-FIZICHESKIY ZHURNAL in Russian Vol 46, No 5, May 84 (manuscript received 20 Dec 82) pp 804-808

BELOGLAZOV, A. A. and BERKOVSKIY, B, M., Institute of High Temperatures, USSR Academy of Sciences

[Abstract] An ambiguity parameter is introduced to allow for plasma heterogeneity and heterogeneity of the current density across the channel. The relationship between this parametes and the variation in the current density across the channel is analyzed using the example of a stationary two dimensional electrodynamic problem. It is found that the ambiguity parameter can be minimized by shaping the current density in the channel cross section, which is especially important when using lower channel wall temperatures. Figure 1, references 10: 6 Russian, 4 Western.
[333-6900]

OBSERVATION OF JUMP SHIFT OF RECOMBINATION RADIATION OF MULTIPLY CHARGED SILICON IONS IN LASER PLASMA

Leningrad PIS'MA V ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 10, No 12, 26 Jun 84 (manuscript received 27 Feb 84) pp 705-709

BASOV, N. G., KALASHNIKOV, M. P., MIKHAYLOV, Yu. A., RODE, A. V., SKLIZKOV, G. V. and FEDOTOV, S. I., Physics Institute imeni P. N. Lebedev, USSR Academy of Sciences

[Abstract] The shift in the jump in intensity of recombination radiation of ions in the direction of long waves due to the drop in the ionization potentials of the ions in a dense plasma was analyzed. Experiments are cited that exhibit shifts in the jump wavelength for germanium and ionized silicon. Recording the jump in recombination radiation intensity makes it possible to determine the electron temperature of the plasma as well as its density. Figures 3, references 8: 5 Russian, 3 Western.
[391-6900]

UDC 621.375.8

ANALYTICAL SOLUTION OF KINETIC EQUATIONS OF COPPER VAPOR PLASMA IN IONIZATION MODE

Moscow TEPLOFIZIKA VYSOKIKH TEMPERATUR in Russian Vol 22, No 2, Mar-Apr 84 (manuscript received 14 Apr 83) pp 243-247

VORONYUK, L. V., GRECHKO, L. G., KOMAROV, O. V., NINKEVICH, I. P., SELISHCHEV, P. A. and SIDENKO, T. S., Kiev State University

[Abstract] An analytical solution is proposed for the kinetic equations of copper vapor plasma in the ionization mode. The formulas derived are used to find the efficiency and specific lasing energy in a copper vapor plasma. The efficiency and specific lasing energy for the green and yellow lines of copper are found to be a strong function of the temperature T_0 characterizing the level population when the excitation pulse is initiated. The initial population of the metastable levels is of fundamental importance. The effect of population and depopulation reactions of the metastable level on the specific green-line pulsed energy is analyzed; it is found that the population process of the metastable level plays a predominant role at low electron temperatures, but that the influence of both processes becomes equal when the electron temperature exceeds approximately 5 eV. The proposed method can be extended to the case of a large number of levels and a complex plasma, and can be used to analyze a lasing plasma in the multipulse mode. References 8: 6 Russian, 2 Western.
[331-6900]

UDC 621.313.522:622.215.2

EFFICIENCY OF ENERGY CONVERSION IN EXPLOSIVE MHD GENERATOR

Moscow TEPLOFIZIKA VYSOKIKH TEMPERATUR in Russian Vol 22, No 2, Mar-Apr 84 (manuscript received 25 May 83) pp 407-409

KONDRATENKO, M. M., LEBEDEV, Ye. F. and OSTASHEV, V. Ye., Institute of High Temperatures, USSR Academy of Sciences

[Abstract] The influence that exchange of energy between detonation products and a plasmoid has on energy conversion efficiency in an MHD generator is investigated on a model of a linear explosive MHD generator comprising a 5 x 10 cm MHD channel and an explosion chamber. The energy conversion process dynamics is investigated by varying the magnetic field in the channel and the initial argon pressure. Conditions are identified under which energy conversion efficiency can be increased for the case of transfer of energy between the plasmoid and detonation products. Conversion efficiency in a model of a linear VG-10 MHD generator is estimated as an example. Figures 2, references 6: 3 Russian, 3 Western.
[331-6900]

UDC 621.378.9

INFLUENCE OF TARGET POTENTIAL ON PRINCIPLES OF EJECTION OF LASER PLASMA IONS

Minsk VESTSI AKADEMII NAVUK BSSR: SERYYA FIZIKA-MATEMATYCHNYKH NAVUK in Russian No 3, May-Jun 84 (manuscript received 1 Dec 83) pp 34-37

KISELEVSKIY, L. I. and SHKURKO, V. V., Institute of Physics, Belorussian SSR Academy of Sciences

[Abstract] The energy distributions of plasma ions striking the geometric shadow region of a target, i.e., ions ejected at angles exceeding 90° are investigated. The influence of the conducting properties of the target materials on the maximum recording angles of the ion component of the plasma is also studied. It is found that the potential acquired by the target when irradiated by a laser pulse may have a significant influence on the energies and trajectories of the plasma ions moving at a surface, causing the ions to be deflected into the geometric shadow region of the target. References 6: 3 Russian, 3 Western.
[370-6900]

UDC 533.92:621.039.61

SUBMILLIMETER INTERFEROMETER-BASED SYSTEM FOR MEASURING RADIAL PLASMA DENSITY PROFILE IN L-2 STELLARATOR

Leningrad ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 54, No 6, Jun 84 (manuscript received 28 Jun 83) pp 1101-1106

KLADOV, S. V. and SMIRNOVA, A. D., Physics Institute imeni P. N. Lebedev, USSR Academy of Sciences

[Abstract] An eight-channel interferometer based on an HCN laser operating at 337 μm is developed for measuring the radial plasma density profile in an L-2 stellarator. A Michelson interferometer with the mirrors placed inside the stellarator chamber is employed. The plasma density is determined from the phase radiation in the low frequency signal obtained when the measurement beam interferes with a reference beam whose frequency is offset with respect to that of the measurement beam by means of a phase modulator. The radial profile is reconstructed from chord measurements by means of Pikalov's program for reconstructing the local coefficients of emission of an elliptical plasma object. Figures 3, references 10: 2 Russian, 8 Western.
[387-6900]

RESIDUAL DEFORMATIONS OF CYLINDRICAL SHELLS DURING LOCAL ACTION OF INTERNAL PRESSURE PULSE

Novosibirsk FIZIKA GORENIYA I VZRYVA in Russian Vol 20, No 2, Mar-Apr 84 (manuscript received 8 Jan 82; revised 1 Feb 83) pp 94-97

NAYDA, A. A.

[Abstract] An infinitely long cylindrical shell subjected to an ideal internal pressure pulse is investigated. Expressions are derived for the kinetic energy delivered to the shell, for the membrane deformations along the x and y axes and for the total shell deformation energy. Experiments are conducted to verify the validity of the latter expression. The experimental findings indicate that the expressions can be used to estimate the residual deformations of cylindrical shells caused by the local action of internal pressure pulses. References 5 Russian.
[304-6900]

EXPERIMENTAL INVESTIGATION AND ANALYSIS OF OSCILLATIONS OF THIN-WALLED SPHERICAL SHELL DURING PULSE LOADING

Novosibirsk FIZIKA GORENIYA I VZRYVA in Russian Vol 20, No 2, Mar-Apr 84 (manuscript received 18 Nov 82; revised 24 Jun 83) pp 97-102

MAL'TSEV, V. A., KONON, Yu. A., ADISHCHEV, V. V, and KORNEV, V. M.

[Abstract] The deformation of an air-filled thin-walled spherical shell subjected to a shock wave from centrally located concentrated charges is examined experimentally. A frequency analysis is made of the oscillations excited in the shell, and the level of flexural and membrane stresses is estimated. The maximum equivalent stresses caused by the ignition of centrally located concentrated charges are found to be the same as the maximum actual stresses, and the latter exceed the estimates for the ideal statement of the problem by factors of two or three. Flexural forms of oscillations are found to have a significant contribution to the stress-strain state. The number of flexural modes of oscillations excited is limited, and their frequencies differ from that of the fundamental mode by

no more than 20%. The existence of parametric instability of oscillations of a spherical shell is confirmed experimentally. References 15: 13 Russian, 2 Western.
[304-6900]

USE OF MANGANIN TRANSDUCERS TO INVESTIGATE NEAR ZONE OF EXPLOSION

Novosibirsk FIZIKA GORENIYA I VZRYVA in Russian Vol 20, No 3, May-Jun 84 (manuscript received 29 Apr 83) pp 23-25

ZHANUKAYEV, A. N., VURCHENKO, V. A., YEGOROV, A. P., KRASAVIN, S. V. and TSIREL', S. V.

[Abstract] The use of manganin pressure transducers to investigate the propagation of shock waves in marble is described. It is found that marble subjected to shock waves with amplitude of 5-14 GPa behaves in general in accordance with the model of an elastic plastic medium. Manganin transducers placed in the rock at different distances from the charge are found to be helpful for studying rock in the near zone of explosions. Figures 3, references 7: 5 Russian, 2 Western.
[405-6900]

SPLITTING OF AUSTENITE STEEL IRRADIATED BY SINGLE LASER PULSE

Leningrad PIS'MA V ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 10, No 5, 12 Mar 84 (manuscript received 29 Nov 83) pp 290-293

BURDONSKIY, I. N., GROMOV, B. I., YEROFEYEV, M. V., ZHUZHUKALO, Ye. V., KALIN, A. A. and NIKOLAYEVSKIY, V. G.

[Abstract] The use of powerful nanosecond light pulses to generate ultrashort stress pulses in austenite steel is examined. The action of an 80-J single-pulse laser resulted in the ablation of matter from the surface of the specimen, causing an elliptical crater 85 μm deep. It is demonstrated experimentally that laser loading makes it possible to produce splitting in ductile steel, which is practically the only current information regarding the behavior of solid bodies in the nanosecond loading region. Figures 2, references 7: 4 Russian, 3 Western.
[384-6900]

UDC 539.3

CALCULATION OF DISTRIBUTION OF FRAGMENT DIMENSIONS DURING DESTRUCTION OF CYLINDRICAL SHELLS

Leningrad VESTNIK LENINGRADSKOGO UNIVERSITETA: MATEMATIKA, MEKHANIKA, ASTRONOMIYA in Russian Vol 7, No 2, Apr 84 (manuscript received 28 Jun 82) pp 118-121

CHASHNIKOV, V. F.

[Abstract] A method is proposed for finding the fragment distribution by width and length assuming dispersion in the amount of relative elongation during destruction, and assuming that the destruction process is a wave process. It is concluded that the elapsed time between the formation of cracks reduces, with a consequent reduction in fragment dimension, as the deformation rate increases. References 12: 9 Russian, 3 Western.
[340-6900]

UDC 539.376

ESTIMATION OF SERVICE LIFE UNDER CONDITIONS OF HIGH-TEMPERATURE CYCLIC LOADING

Novosibirsk ZHURNAL PRIKLADNOY MEKHANIKI I TEKHNICHESKOY FIZIKI in Russian Vol 144, No 2, Mar-Apr 84 (manuscript received 6 Jan 83) pp 144-148

GOLUB, V. P.

[Abstract] An approach to analytical modeling of cyclic service life for the high temperature region is proposed for construction materials subjected to repeated loading. The stress state of a specimen rod is analyzed by the kinetic approach. Service life under conditions of cyclic creep, fatigue service life and service life under conditions of interaction of fatigue and creep are analyzed. The limiting stress patterns for EI867 alloy at 930°C are calculated as an example. It is demonstrated that service life is shorter when fatigue and creep interact than for creep or fatigue alone. Figures 3, references 12: 10 Russian, 2 Western.
[320-6900]

UDC 62-50

FORCED PERIODIC OSCILLATIONS IN NONLINEAR SYSTEMS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 276, No 6, Jun 84 (manuscript received 27 Sep 83) pp 1356-1359

KRASNOSEL'SKIY, A. M., All-Union Cardiological Center

[Abstract] New assertions are formulated with respect to forced oscillations: existence features, uniqueness features, and conditions for applicability of harmonic balance method, inter alia. The assertions are based on the arguments of the eigenvalues of the corresponding linear operators. A theorem is devised which is employed in combination with the Schauder-Leray principle and the general theory of projection methods to prove the existence of periodic solutions and to validate the harmonic balance method. The unqiueness proof is also based on the same theorem. References 8 Russian. [407-6900]

SPATIAL UNSTABLE COMBUSTION MODES OF SPECIMEN OF GASLESS COMPOSITION IN FORM OF LONG SQUARE ROD

Novosibirsk FIZIKA GORENIYA I VZRYVA in Russian Vol 20, No 2, Mar-Apr 84 (manuscript received 8 Dec 82; revised 11 May 83) pp 23-28

SHCHERBAK, S. B.

[Abstract] The unsteady spatial problem of combustion of a gasless specimen consisting of a long square rod is analyzed numerically. Three spatial combustion modes - thin, angular and circular - are obtained in the region of instability. The development of perturbations in the plane combustion wave prior to reaching the final state is investigated. The problem is subjected to linear analysis, and the findings are compared with the results of solving the complete problem. Figures 3, references 13 Russian. [304-6900]

UDC 532.595.2+135

PRESSURE WAVE PROPAGATION IN VISCOUS ELASTIC PLASTIC MEDIA DURING MOVEMENT THROUGH TUBES

Baku IZVESTIYA AKADEMII NAUK AZERBAYDZHANSKOY SSR: SERIYA FIZIKOTEKHNICHESKIKH I MATEMATICHESKIKH NAUK in Russian Vol 4, No 5, Sep-Oct 83 (manuscript received 4 Oct 82) pp 131-134

SATTAROV, R. M., GUSEYNOV, A. A. and MAMEDOV, R. M., Institute of Mathematics and Mechanics

[Abstract] The process of pressure perturbation in a medium described by a relaxation plastic model is examined. A system of differential equations is derived for the motion of the relaxation medium in the tube. A formula derived for the dimensionless pressure is tested for different coefficients of friction and relaxation times. Figures 2, references 2 Russian.
[350-6900]

UDC 621.315.592

APPROXIMATION AND INVESTIGATION OF KINETIC EFFECTS IN FIELD OF STRONG ELECTROMAGNETIC WAVE

Tomsk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: FIZIKA in Russian Vol 27, No 5, May 84 (manuscript received 31 Mar 83) pp 19-23

NGUYEN, KHONG SHON, SHMELEV, G. M. and EPSHTEYN, E. M., Kishinev State University imeni V. I. Lenin

[Abstract] The approximation describing the interaction of an electron gas with a strong electromagnetic field employed in a number of studies is shown to be incorrect. Examples of incorrect results based on that approximation are cited. A correction is proposed, and formulas are derived for the gain of the phonons (plasmons) of the electromagnetic wave. References 9: 2 Russian, 7 Western.
[348-6900]

UDC 534.2:535.3

AVERAGE INTENSITY OF MULTIPLY SCATTERED WAVES

Tomsk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: FIZIKA in Russian Vol 27, No 5, May 84 (manuscript received 18 Oct 83) pp 85-90

PONOMAREV, G. A., Siberian Physical-Technical Institute imeni V. D. Kuznetsov, Tomsk State University

[Abstract] The average intensity of the scalar field excited by a concentrated source is analyzed on the basis of the theory of multiple scattering of waves for the case in which the source and observation point are close together and separated from one another by a shield. Expressions are derived for the coherent and incoherent intensity components at points within the layer. The average thermal intensity is analyzed as a function of distance, wavelength and other parameters. References 6: 5 Russian, 1 Western.
[348-6900]

EXACT NONLINEAR THEORY OF SPREADING OF ELECTRON BEAM INTO INDIVIDUAL BUNCHES IN PLASMA

Moscow ZHURNAL EKSPERIMENTAL'NOY I TEORETICHESKOY FIZIKI in Russian Vol 86, No 2, Feb 84 (manuscript received 4 Jun 83) pp 479-482

VULANOV, S. V. and SASOROV, P. V., Physics Institute imeni P. N. Lebedev, USSR Academy of Sciences

[Abstract] Equations describing the interaction of a monoenergetic beam and a cold plasma are derived and solved exactly for a long-wave perturbation approximation. Formulas are derived that describe the spreading of a beam into individual parts. The evolution of a beam of finite dimensions in which the density is a parabolic function of coordinates and the rate is a linear function of x is examined. The equations and solutions obtained can be used to investigate beam bunching and splitting with allowance for nonlinearity of the plasma as well as the beam. Figure 1, references 5: 4 Russian, 1 Western.
[323-6900]

UDC 621.01:531.66

PROPELLING OF UNSECURED SOLID BODY ALONG FLAT BARRIER BY AIR SHOCK WAVE

Novosibirsk ZHURNAL PRIKLADNOY MEKHANIKI I TEKHNICHESKOY FIZIKI in Russian Vol 144, No 2, Mar-Apr 84 (manuscript received 26 Jan 83) pp 119-128

KOTLYAREVSKIY, V. A.

[Abstract] A body is analyzed that has a plane of material symmetry with forces acting in it corresponding to the plane-parallel movement of a body with a variable number of degrees of freedom. The system of forces in the diffraction phase is assumed to be independent of immaterial displacements of the body, and forces in the streamline flow phase are determined by steady-state aerodynamic formulas in which time is a parameter. Initial conditions for the occurrence of different forms of movement are examined, and transient conditions associated with changes in shape as the body strikes the barrier are analyzed. The movement of a parallelepiped body loaded by a shock wave with wave front pressure of 0.1 MPa and positive velocity pressure duration of 0.065 s is analyzed. Possible displacements of the surface of a barrier bounding a linearly elastic half-space are estimated and are found to be negligibly small for the cases analyzed. Figures 4, references 5 Russian. [320-6900]

UDC 537.525:541.183

ATMOSPHERIC FORMATION AND ABSORPTION DUE TO DIFFUSION OF ABSORBED GAS

Leningrad ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 54, No 4, Apr 84 (manuscript received 18 Jul 83) pp 763-771

IGNATOV, V. A., NAUMENKOV, S. P., STAKHANOV, I. P., Moscow Institute for Precision Chemical Technology imeni M. V. Lomonosov

[Abstract] The dynamics of the formation and absorption of atmosphere due to adsorption and desorption of gas by solid bodies is subjected to rigorous mathematical analysis. A solid body is examined that contains a cavity within the walls of which a gas is dissolved. When the equilibrium is disturbed by a rapid change in the wall temperature or of the state of the gas in the cavity the gas begins to be absorbed or desorbed by the wall. A new stable state is finally reached in which the density of the gas atmosphere in the chamber may differ from the original density (depending upon the direction in which the temperature changes and the nature of the solubility of the gas). The analytical findings are confirmed by numerical calculation. Figures 5, references 7 Russian.
[319-6900]

UDC 536.24

MIXED BOUNDARY VALUE PROBLEM OF HEAT CONDUCTION FOR ROTATING CYLINDER

Yerevan DOKLADY AKADEMII NAUK ARMYANSKOY SSR in Russian Vol 78, No 1, Jan 84 pp 28-32

MINASYAN, R. S., Institute of Mathematics, Armenian SSR Academy of Sciences

[Abstract] The problem of heat propagation in an infinite homogeneous cylinder rotating at a fixed angular velocity with heat exchange between the surface and the ambient medium is solved. The coefficient of heat exchange and the ambient temperature are assumed to be time-independent. Heat release within the cylinder is assumed to vary in intensity along the radius. A differential equation in stationary coordinates is derived for the quasisteady heat field of the cylinder. References 7: 6 Russian, 1 Western.
[396-6900]

UDC 612.014.421.5

POSSIBILITIES OF OBTAINING INFORMATION BY ANALYZING FLUCTUATIONS OF THERMAL RADIATION OF BIOLOGICAL OBJECTS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 277, No 1, Jul 84 (manuscript received 16 Aug 83) pp 81-83

KOBRIN, M. M., ORLOV, I. Ya. and YEGORYCHEV, V. P., Gorkiy Scientific Research Radio Physical Institute

[Abstract] Instrumentation is described for investigating fluctuations in the thermal radiation of biological objects, including high sensitivity modulation radiometers operating at 10 and 3 cm and having 1000-MHz bandwidth and 0.02 K threshold sensitivity (with integration time of one second). The use of this equipment to record measurements from different regions of the human body is described. The amplitude distribution function of the fluctuations of the radiation of the human body has a clearly defined

multimodal nature, in contrast to the distribution functions of the radiation of an equivalent emitter, which are near-Rayleigh in appearance. The possible nature of the interaction between the noise and quasiperiodic components is modeled. The fluctuations of the thermal radiation in the microwave region are compared with the modeling results, indicating that the distribution function of the fluctuation amplitudes of the thermal radiation from biological objects depends strongly upon the region of radiation investigated. Figures 2, references 6: 5 Russian, 1 Western.
[412-6900]

STRUCTURE OF DIFFUSION FLAME UNDER WEIGHTLESS CONDITIONS

Novosibirsk FIZIKA GORENIYA I VZRYVA in Russian Vol 20, No 2, Mar-Apr 84 (manuscript received 18 Nov 82; revised 28 Mar 83) pp 55-60

SMASONOV, V. P.

[Abstract] Diffusion flames of burning ethyl alcohol and benzene are studied interferometrically under weightless conditions, making it possible to determine the boundaries of the glowing zone of the flame by direct photography, and to visualize the expanding combustion product zone and to calculate the temperature field of the flame. An experimental setup employing a burner in a hermetically sealed container is described. Experiments were conducted under normal gravitational conditions, and with the box falling freely. The influence of gravity on the heat flow from the combustion zone to the surface of the fuel due to heat conductivity is analyzed. References 15: 9 Russian, 6 Western.
[304-6900]

THERMAL EXPLOSION IN LAYER OF REAGENT LIQUID BOUNDED BY MASSES WITH DIFFERENT HEAT CONDUCTIVITY

Novosibirsk FIZIKA GORENIYA I VZRYVA in Russian Vol 20, No 2, Mar-Apr 84 (manuscript received 11 Nov 82; revised 28 Feb 83) pp 91-94

KOLESNIKOV, A. K.

[Abstract] The findings of D. A. Frank-Kamenetskiy regarding thermal explosion in a reagent layer bounded by ideally heat-conducting planes are extended to a layer contained between solid masses with heat conductivity differing from that of chemically active substance. The temperature and heat flow on the boundaries of the layer are assumed to be constant. The general case in which the masses differ in thickness and heat conductivity is investigated. The critical values of the Frank-Kamenetskiy parameter Fk are found for a wide range of variation in the parameters of the masses bounding the reaction zone. The relative heat conductances of the masses

and their dimensions have a strong influence on the critical conditions for thermal explosion. Figures 4, references 3 Russian.
[304-6900]

METHOD FOR CALCULATING PARAMETERS OF DETONATION OF CONDENSED EXPLOSIVES

Novosibirsk FIZIKA GORENIYA I VZRYVA in Russian Vol 20, No 3, May-Jun 84 (manuscript received 18 Feb 83) pp 83-86

KRIVCHENKO, A. L.

[Abstract] The detonation parameters of an explosive charge are estimated through the waveguide properties of the explosive and the explosion heat. The calculated and experimental detonation rates of maximum-density explosives are tabulated and compared, showing good convergence between the theoretical and experimental values. Formulas are derived for the detonation pressure and polytropic index of the process. The method makes it possible to use easily predicted characteristics to determine the relevant parameters with good accuracy. References 9 Russian.
[405-6900]

UDC 532.68:532.542:536.423

LIMITING CHARACTERISTICS OF INCLINED THERMOSIPHONS IN HEAT PIPES WITH EXCESS COOLANT

Minsk INZHENERNO-FIZICHESKIY ZHURNAL in Russian Vol 46, No 5, May 84 (manuscript received 22 Dec 82) pp 709-716

VASIL'YEV, L. L., GRAKOVICH, L. P. and KHRUSTALEV, D. K., Institute of Heat- and Mass-Exchange imeni V. V. Lykov, Belorussian SSR Academy of Sciences

[Abstract] A method is developed for calculating the heat transfer limit of gravity heat pipes with wicks with low axial permeability and inclined evaporative thermosiphons. The heat-transfer resistance of the latter under near-limiting loads is investigated. The model developed is verified experimentally by investigating the heat transfer characteristics of a thermosiphon with a stainless steel housing as a function of the charge mass and angle of inclination. It is demonstrated that the coefficients of heat transfer in an inclined thermosiphon can be fairly low. The hydrodynamic model of heat transfer examined makes it possible to determine the heat transfer limit of an inclined evaporative thermosiphon with a small amount of coolant and of a gravitational heat pipe inclined at angles to the horizintal of up to 50°. The findings can be used to construct a general mathematical model for a gravitational heat pipe with excess coolant. Figures 4, references 4: 2 Russian, 2 Western.
[333-6900]

UDC 536.3

INVESTIGATION OF COMPLEX RADIATION-CONDUCTIVE HEAT EXCHANGE IN CRYOGENIC MULTILAYERED VACUUM THERMAL INSULATION

Minsk INZHENERNO-FIZICHESKIY ZHURNAL in Russian Vol 46, No 5, May 84 (manuscript received 4 Mar 83) pp 754-760

MUL'MAN, S. B. and KAGANER, M. G., Geliymash Scientific Production Association

[Abstract] The problem of the combined transfer of heat by radiation and conduction in a flat layer of a radiating, absorbing and isotropically scattering medium contained between two opaque boundary surfaces with different temperatures is solved analytically, assuming that the properties of the medium are independent of the wavelength of the radiation. A semi-empirical formula is derived that describes the complex radiation-conductive heat transfer in vacuum-multilayer insulation and makes it possible to assess qualitatively and quantitatively the influence of insert materials on its optical properties. References 8: 4 Russian, 4 Western.
[333-6900]

UDC 536.24

USE OF PROJECTION-GRID METHOD TO SOLVE CONJUGATE UNSTEADY PROBLEM OF HEAT EXCHANGE IN COMPLEX ANNULAR CHANNEL

Minsk INZHENERNO-FIZICHESKIY ZHURNAL in Russian Vol 46, No 5, May 84 (manuscript received 14 Dec 82) pp 849-853

DAVYDOVA, N. N., KOCHUBEY, A. A. and RYADNO, A. A., Dnepropetrovsk State University

[Abstract] A projection-grid method combining the finite-element method and the finite-difference method is employed to investigate the influence of the geometric characteristics of channels on different parameters of processes occurring in them. A laminar-hydrodynamically stabilized liquid flow in a complex annular channel is examined. The temperature fields in the wall and the stream of liquid are found to be interrelated; the configuration of the cross section of the channel has a strong influence on the temperature distribution. A number of programs are developed for investigating heat exchange in channels with practically any cross sections and for studying the influence of unsteadiness, geometry, wall material properties and other parameters on the heat exchange process. Figures 2, references 7 Russian.
[333-6900]

UDC 532.526

HEAT EXCHANGE ON OBLAKO WEATHER ROCKET DURING BOUNDARY LAYER DETACHMENT

Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR: SERIYA TEKHNICHESKIKH NAUK in Russian No 4, Iss. 1, Mar 84
(manuscript received 22 Sep 83) pp 52-63

PAVLYUCHENKO, A. M., TYUTIN, A. A. and KORABLEV, A. V., Novosibirsk State University, Institute of Theoretical and Applied Mechanics, Siberian Department, USSR Academy of Sciences

[Abstract] The wall temperature distribution in the boundary layer detachment region ahead of the step at the head of a supersonic "Oblako" weather rocket is measured. A temperature peak is shown to occur in the detachment zone. It is found that the boundary layer detaches in the laminar state, and that the flow reattaches in the transitional mode of the detached boundary layer, which is the cause for the temperature peak. The temperature distributions are approximated by computer using 7th-degree orthogonal Chebyshev polynominals. Figures 17, references 35: 23 Russian, 12 Western.
[349-6900]

UDC 533.6.011

NONMONOTONIC RELATIONSHIP BETWEEN HEAT TRANSFER AND TEMPERATURE DIFFERENTIALS

Moscow TEPLOFIZIKA VYSOKIKH TEMPERATUR in Russian Vol 22, No 2, Mar-Apr 84
(manuscript received 22 Oct 82) pp 363-371

ALEKSANDROV, V. Yu.

[Abstract] Heat flow is analyzed as a function of the temperature ratio for a wide range of temperature values in the transitional region through a numerical solution of a problem of unidimensional heat transfer for a nonlinear relaxation kinetic equation. The relationship between the heat flow and temperature differential is analyzed; solution of the nonlinear relaxation kinetic equation established that the behavior of the heat flow is nonmonotonic when the temperature gradients are large in a region that is transitional in terms of degree of gas rarefaction. Figures 4, references 5: 4 Russian, 1 Western.
[331-6900]

UDC 539.3.536.2

DYNAMIC PROBLEM OF HEATING OF ELASTIC THIN-WALLED TUBE OF FINITE LENGTH

Moscow VESTNIK MOSKOVOGO UNIVERSITETA: SERIYA 1, MATEMATIKA, MEKHANIKA in Russian No 3, May-Jun 84 (manuscript received 10 Oct 81) pp 91-93

CHAYKA, T. I.

[Abstract] A linearly elastic cylindrical tube secured at the ends is examined. The linear hyperbolic system of differential equations of axisymmetric motion from the dynamic theory of elasticity are solved by the spatial characteristic method. An example of numerical calculation by computer for a carbon steel pipe is presented. Figures 3; references 4 Russian. [341-6900]

UDC 519.1

CONNECTEDNESS OF GRAPHS WITH PRESCRIBED POWER SET AND ORDER. UNIGRAPHISM

Minsk DOKLADY AKADEMII NAUK BSSR in Russian Vol 28, No 5, May 84
(manuscript received 10 May 83) pp 400-403

CHERNYAK, A. A., Institute for Problems of Machine Reliability and Durability, Belorussian SSR Academy of Sciences

[Abstract] The problem of the existence and construction of graphs with the greatest vertex (edge) connectedness and having prescribed power set and order is solved. The graphs defined uniquely to the point of isomorphism by these parameters are characterized. The basic assertions set forth in a separate study concerning the computation of the generalized cell function are extended. The results are used to investigate the reliability of a complex system. The paper introduces the concept of unigraphism, defined as follows. Let $k_1 < \ldots < k_n < p$ be positive integers. The group $\{k_n,\ldots, k_n|p\}$ is called a graphic group if there exists a graph G on p vertices with power set $\{k_1,\ldots, k_n\}$, i.e. G is a realization of the given group. If this group has a unique realization, it is called unigraphic. References 11 Western.
[374-6900]

UDC 519.21

ESTIMATION OF PROBABILITY OF STRIKING BULLSEYE WITH NON-ZERO CENTER IN HILBERT SPACE

Minsk DOKLADY AKADEMII NAUK BSSR in Russian Vol 28, No 6, Jun 84
(manuscript received 30 Jun 83) pp 499-501

ZALESSKIY, B. A., Institute of Mathematics, Belorussian SSR Academy of Sciences

[Abstract] New nonuniform upper-bound estimates of the probability of hitting a bullseye with a non-zero center in Hilbert space are constructed. These estimates are used extensively in mathematical statistics and in the theory of random processes. References 7: 5 Russian, 2 Western.
[347-6900]

UDC 62-50

PERTURBATION METHOD FOR SOLVING A LINEAR OPTIMAL CONTROL PROBLEM

Minsk DOKLADY AKADEMII NAUK BSSR in Russian Vol 28, No 6, Jun 84
(manuscript received 29 Jun 83) pp 502-505

KALININ, A. I. and ROMANYUK, G. A., Belorussian State University imeni V. I. Lenin

[Abstract] An algorithm based on the asymptotic perturbation method is suggested for the approximate solution of a linear optimal control problem. The concept of key, key control, and control values is introduced in the base problem as well as the perturbation problem. When the parameter μ is small enough the key for the base problem is also the key for the perturbed problem. An adaptive solution method is used to obtain the key control of the base problem. References 2 Russian.
[347-6900]

UDC 519.283

METHOD FOR SOLVING DIFFERENTIAL-DIFFERENCE EQUATION OCCURRING IN QUEUEING THEORY

Minsk DOKLADY AKADEMII NAUK BSSR in Russian Vol 28, No 7, Jul 84
(manuscript received 15 Jul 83) pp 585-587

MATALYTSKIY, M. A., Belorussian State University imeni V. I. Lenin

[Abstract] A closed queueing system consisting of two types of subsystems, the first type being of absolute priority, is described. The differential-difference equation describing the probability distribution of the states of the system is solved by successive approximation in conjunction with the method of series for solving differential equations. Two theorems are stated and proved. References 3: 2 Russian, 1 Western.
[401-6900]

UDC 519.854.2

EFFECTIVE CONSTRUCTION OF NEAR-OPTIMAL SCHEDULES FOR ARBITRARY AND ALTERNATIVE PART ROUTING

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 276, No 1, May 84 (manuscript received 20 Jun 83) pp 46-48

SEVAST'YANOV, S. V., Institute of Mathematics, Siberian Department, USSR Academy of Sciences

[Abstract] A geometric method is developed by which algorithms can be constructed for the Akers-Friedman problem of finding the optimal schedule for processing n parts on m machine tools where the route followed by each part from machine to machine is a transposition of a set of numbers. The method developed can be used to construct effective exact and approximate algorithms with guaranteed accuracy estimates for the Akers-Friedman problem, as well as extensions in the case of arbitrary routes and alternative routes for each part. Three problems are analyzed as examples: a problem with cyclic technological routings, a problem of uniform assignment of rocks to piles with forbidden events, and a problem of alternative routes and alternative executors. References 9 Russian.
[329-6900]

UDC 517.9:537.874.6

NUMERICAL METHOD FOR SOLVING PROBLEMS OF ELECTROMAGNETIC WAVE DIFFRACTION ON OPEN SURFACES OF ARBITRARY SHAPE

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 276, No 1, May 84 (manuscript received 4 Oct 83) pp 96-100

DAVYDOV, A. G., ZAKHAROV, Ye. V. and PIMENOV, Yu. V., Moscow State University imeni M. P. Lomonosov

[Abstract] A new method for the numerical solution of problems of diffraction of electromagnetic waves on open surfaces of arbitrary shape is developed in which the problem is reduced to integro-differential equations of the first kind in which the integro-differential operator can be algorithmized effectively. The derivation of the integro-differential equations is described. An algorithm for solving the resulting system numerically is presented. The field amplitude distribution at the focus of a segment of a paraboloid of rotation irradiated by a plane wave is calculated as an example. Figures 2, references 6: 5 Russian, 1 Western.
[329-6900]

UDC 518.517

EXPLICIT NONLINEAR NUMERICAL METHODS FOR SOLVING ORDINARY DIFFERENTIAL EQUATIONS

Kiev DOKLADY AKADEMII NAUK UKRAINSKOY SSR: SERIYA A. FIZIKO-MATEMATICHESKIYE I TEKHNICHESKIYE NAUKI in Russian No 5, May 84
(manuscript received 26 Oct 82) pp 21-24

SLONEVSKIY, R. V. and GLUSHIK, M. M., Lvov Polytechnical Institute

[Abstract] Explicit nonlinear methods are proposed for solving differential equations with larger regions of absolute stability than the Adams-Bashforth explicit linear multistep methods. The integration step in the proposed method is larger, and no inversion of the Jacobi matrix is required, thus speeding up the computation for providing satisfactory accuracy. The proposed method was investigated on model equations and systems of equations with component-by-component realization. References 3: 1 Russian, 2 Western.
[375-6900]

UDC 533.66.063

THE BAYESIAN APPROACH IN ANALYZING EXPERIMENTAL DATA

Baku IZVESTIYA AKADEMII NAUK AZERBAYDZHANSKOY SSR: SERIYA FIZIKO-TEKHNICHESKIKH I MATEMATICHESKIKH NAUK in Russian Vol 4, No 4,
Jul-Aug 83 (manuscript received 14 Apr 82) pp 79-84

ALIYEV, R. A., VAN'KOV, A. A., ISKENDEROV, S. M. and NOVIKOV, A. G.

[Abstract] A constructive approach is proposed for regularizing solutions by introducing an a priori vector estimate and a priori error matrix estimate into the initial system. The effectiveness of the method is demonstrated by analyzing the findings of an experiment on the quasi-elastic scattering of thermal neutrons by water. Parametrization of the data points is discussed. Simultaneous, or joint, analysis of all available experimental data is described. Figures 4, references 10: 9 Russian, 1 Western,
[325-6900]

UDC 681.511.2.22

CONTROL METHOD EMPLOYING DIGITAL OBSERVATION DEVICES

Baku IZVESTIYA AKADEMII NAUK AZERBAYDZHANSKOY SSR: SERIYA FIZIKO-TEKHNICHESKIKH I MATEMATICHESKIKH NAUK in Russian Vol 4, No 4, Jul-Aug 83 (manuscript received 31 Jan 83) pp 107-111

BELYANSKIY, P. V., GASANOV, E. E., MAKSIMOV, Yu. M. and FILIN, V. V., Institute of Sibernetics, Azerbaijan SSR Academy of Sciences, Scientific Research Institute for Instrument Engineering, Gorkiy Polytechnical Institute imeni A. A. Zhdanov

[Abstract] An approach is proposed for solving the control problem for complex dynamic objects in which the complete state vector of the entire system cannot be measured. The control law is formed on the basis of the measured components of the state vector and the dynamics of the unmeasured components alone. A theorem is stated and solved that makes it possible to synthesize an optimal regulator employing observed inputs and outputs alone. The effectiveness of the method is demonstrated by the example of controlling an antenna installation in which the reflector dynamics is approximated by a three-mass model. Mean-square optimization employing various methods makes it possible to design optimal digital regulators requiring a comparatively small amount of computation. Figures 2, references 5: 4 Russian, 1 Western.
[325-6900]

UDC [53.072:51]:[502.55(203)](-21)

SELF-ORGANIZING MODEL OF POLLUTION OF AIR BASIN OF INDUSTRIAL CITY

Baku IZVESTIYA AKADEMII NAUK AZERBAYDZHANSKOY SSR: SERIYA FIZIKO-TEKHNICHESKIKH I MATEMATICHESKIKH NAUK in Russian Vol 4, No 4, Jul-Aug 83 (manuscript received 25 Feb 83) pp 127-133

AZIMOV, B. A., corresponding member, Azerbaijan SSR Academy of Sciences, GORCHIYEV, A. A., KOPPA, Yu. V., RAFIYEV, R. M. and MAMEDOV, M. I., USSR Academy of Sciences

[Abstract] An algorithm employing group allowance for arguments based on the theory of self-organization is proposed for constructing a model of atmospheric pollution of industrial city by harmful pollutants. The universal solution method employed under the theory of self-organization is exhaustive trial and error of mathematical models and combinations thereof while gradually increasing the complexity. The maximum correlation coefficient is employed as the selection criterion; coefficients are estimated by the least-squares method. A model of the sulfur dioxide concentration during the winter is constructed for an observation point. It is found that the concentration of atmospheric pollutants is determined sufficiently well by five weather factors: wind

speed and direction, air temperature, relative humidity and cloud cover. Figures 2, references 7: 6 Russian, 1 Western.
[325-6900]

UDC 681.3.06:51

MATHEMATICAL MODEL FOR ALGORITHMS

Baku IZVESTIYA AKADEMII NAUK AZERBAYDZHANSKOY SSR: SERIYA FIZIKO-TEKHNICHESKIKH I MATEMATICHESKIKH NAUK in Russian Vol 4, No 4, Jul-Aug 83 (manuscript received 14 Apr 82) pp 155-158

GASANOV, R. G., Scientific Research and Design Institute for Integrated Automation in the Petroleum and Chemical Industry

[Abstract] An algorithm is defined as any computational procedure p_1f_1, p_2f_2, ..., p_nf_n in which, starting with the first or any given operator, f_1 is executed if p_1 is true, or the next operator is executed if p_1 is false. Expansion functions are examined in which each term is a fraction with its numerator consisting of the product of the arguments and the denominator consisting of the sum of the products of the arguments. These are called S-functions. It is demonstrated that computational procedures exist that allow computation to be performed by any S-algorithm starting with a given S-operator. The concept of universal algorithm is introduced, and a theorem that every partially recursive function is a universal algorithm is stated and proved. S-algorithms can represent all computational algorithms for partially recursive functions (with respect to G) and, if Church's thesis is correct, all algorithms for computing partial functions as well. References 2 Russian.
[325-6900]

UDC 681

MODULARITY PRINCIPLE - FOUNDATION FOR PARALLEL DIGITAL SIGNAL PROCESSES

Alma-Ata IZVESTIYA AKADEMII NAUK KAZAKHSKOY SSR: SERIYA FIZIKO-MATEMATICHESKAYA in Russian No 3, May-Jun 83
(manuscript received 27 Feb 84) pp 7-10

AMERBAYEV, V. M. and PAK, I. T., Institute of Mathematics and Mechanics, Kazakh SSR Academy of Sciences

[Abstract] It is demonstrated that paralleling of computation on the basis of modularity ensures fast, guaranteed accurate, viable and diagnostically complete digital signal processing algorithms. The principles of the modulator arithmetic employed are explained. The

implementation of modular arithmetic on homogeneous computer systems is discussed. Modular arithmetic makes it possible to speed up algorithms for orthogonal transformations over complex quantities in a trigometric basis, opening up new prospects for special purpose computers implementing such operations. References 11: 8 Russian, 3 Western.
[367-6900]

UDC 517.91

CONSTRUCTION OF ASYMPTOTIC APPROXIMATIONS TO SOLUTIONS OF PULSED SYSTEMS

Alma-Ata IZVESTIYA AKADEMII NAUK KAZAKHSKOY SSR: SERIYA FIZIKO-MATEMATICHESKAYA in Russian No 3, May-Jun 84
(manuscript received 15 Sep 83) pp 74-77

KARKINBAYEV, I., Kzyl-Orda Branch, Dzhambul Hydroreclamation Construction Institute

[Abstract] Classical works in nonlinear mechanics and asymptotic methods in the theory of nonlinear oscillations are employed to investigate oscillating systems subjected to instantaneous perturbations. Asymptotic approximations to the solutions of pulsed systems are constructed for the case of resonance by the Krylov-Bogolyubov method. References 2 Russian.
[367-6900]

UDC 517.93

NONSTANDARD ANALYSIS AND SINGULAR PERTURBATIONS OF ORDINARY DIFFERENTIAL EQUATIONS

Moscow USPEKHI MATEMATICHESKIKH NAUK in Russian Vol 39, No 2, Mar-Apr 84
(manuscript received 24 Jun 83) pp 77-127

ZVONKIN, A. K. and SHUBIN, M. A., Moscow State University imeni M. V. Lomonosov

[Abstract] Nonstandard analysis of ordinary differential equations with "French duck chase" is reviewed. The "ducks" are singular solutions with a small parameter in the theory of relaxation oscillators such as one described by the Van der Pol equation. The analysis begins with the simplest stretching of the real axis and a relevant formulation of the transfer principle for theorems stated in the language of set theory. There follows formulation of three ap licable axioms and proof of the two simplest existence and uniqueness theorems for solutions. A large cycle is considered for the Van der Pol equation and its "ducks" are established. Existence of "duck" solutions in the case of a nondegenerate extremum point is proved with the aid of three

lemmas, two corollaries, and two postulates pertaining to points, trajectories, small-parameter (ε) galaxies, and absence of excursions in the Lienard plane. After standard "ducks" have been defined, a theorem about them is proved on the basis of their simultaneity with nonstandard "ducks". Next are considered approximations of "ducks", by asymptotic expansion in power series with respect to a small parameter ε. Two proofs are given for the existence of such asymptotic expansions, the latter being refined by a special "exponential microscope" change of variables to that the scale around any curve is stretched into one exponentially larger than $1/\varepsilon$. Three similar graphs representing bundles of trajectories in the nonstandard plane, namely a "funnel", a "spout", and a "tunnel", are interpreted and examined as solution patterns in the nonstandard plane. Explicit solutions or "live" ducks are demonstrated on five examples of equations, including a pair of simultaneous ones, and shortness of their "life" or interval of existence is established. The behavior of solutions to fast-slow equations is analyzed qualitatively in terms of singular points. The review concludes with ducks-cycles of the Van der Pol equation and their evolution, the input-output function, and the Diener equation as another one to which "French duck chase" is applicable. The authors thank V. I. Arnol'd, V. E. Lyantse, N. Kh. Rozov for helpful discussions and bibliographic referals, as well as all participants in the seminar chaired by N. Kh. Rozov and M. A. Shubin, especially A. A. Balinskiy and A. S. Demidov.
Figures 29, references 90: 15 Russian, 75 Western.
[324-2415]

UDC 517.9

ESTIMATION OF HOLOMORPHIC SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS

Leningrad VESTNIK LENINGRADSKOGO UNIVERSITETA: MATEMATIKA, MEKHANIKA, ASTRONOMIYA in Russian Vol 7, No 2, Apr 84
(manuscript received 10 Jun 82) pp 9-16

BABADZHANYANTS, L. K. and MGOYAN, P. B.

[Abstract] A system of a finite number of ordinary first-order differential equations solvable for derivatives is examined. The right parts are holomorphic with respect to unknowns and argument, and are linear with respect to parameter. Estimates of the holomorphic region of the solution of the Cauchy problem with respect to argument and parameter are proposed. The proof is based on analogous findings for a polynomial system published elsewhere.
References 7: 6 Russian, 1 Western.
[340-6900]

UDC 517.925.12

PERIODIC SOLUTIONS OF SYSTEMS OF SECOND-ORDER DIFFERENTIAL EQUATIONS

Leningrad VESTNIK LENINGRADSKOGO UNIVERSITETA: MATEMATIKA, MEKHANIKA, ASTRONOMIYA in Russian Vol 7, No 2, Apr 84 (manuscript received 10 Mar 83) pp 98-101

LĔZINA, T. A.

[Abstract] The author considers the system of differential equations

$$\ddot{x}_i + \lambda_i^2 x_i + \phi_i(x_1, \ldots, x_n) = 0, \quad i = 1, \ldots, n. \qquad (1)$$

It is assumed that functions ϕ_i are continuous at all $x_1, \ldots, x_n$, and that they satisfy the condition

$$|\phi_i(x_1, \ldots, x_n)| \leq \gamma' \sqrt{x_1^2 + \ldots + x_n^2}, \quad i = 1, \ldots, n,$$

where γ' is a constant number. It is further assumed that $\kappa_i = \lambda_i/\lambda_1$ is not an integer at $i = 2, \ldots, n$ and $\lambda_i > 0$ at $i = 1, \ldots, n$. It is shown that system (1) has a family of periodic solutions at sufficiently small γ'. The given system has been analyzed from this viewpoint on the assumption that functions ϕ_i are odd with respect to all arguments [see G. L. Yuzbashev, "Family of Periodic Solutions of System of Second-Order Differential Equations Without Dissipation", author's abstract of candidate's dissertation, Leningrad, 1973, 8 pp]. Lĕzina's analysis drops this restriction. References 2 Russian,
[340-6610]

UDC 62-50

CONTROL PERFORMANCE FUNCTIONAL AS FUNCTION OF CONTROL DIGITIZATION STEP

Leningrad VESTNIK LENINGRADSKOGO UNIVERSITETA: MATEMATIKA, MEKHANIKA, ASTRONOMIYA in Russian Vol 7, No 2, Apr 84 (manuscript received 3 Nov 83) pp 116-118

FOMIN, V. N. and SHARYGIN, I. N.

[Abstract] Optimization of a continuous object in a class of controls employing a noisy output only at discrete moments in time is discussed. It is demonstrated that the quadratic control performance functional is a continuous function of the size of the digitization step, making it possible to synthesize control strategies in continuous time with control performance as near optimal as desired. The control strategies can be implemented by digital techniques, and enhance the stability of the control system. Reference 1 Russian.
[340-6900]

UDC 517.94

SYNTHESIS OF CONTROL OF LINEAR SYSTEMS WITH DELAY

Leningrad VESTNIK LENINGRADSKOGO UNIVERSITETA: MATEMATIKA, MEKHANIKA, ASTRONOMIYA in Russian Vol 7, No 2, Apr 84 (manuscript received 13 Apr 82) pp 121-124

SHALYAPINA, O. V.

[Abstract] Existence conditions are derived for control in a synthesized form solving the two-point problem for linear nonstationary systems with variable delays. A similar type of control is constructed for which Stieltjs-type integral boundary conditions hold for any solution of initial system with arbitrarily selected initial functions. References 2 Russian. [340-6900]

UDC 519.624

SOME MODIFICATION OF THE SHOOTING METHOD FOR SOLVING NONLINEAR TWO-POINT BOUNDARY VALUE PROBLEMS

Moscow ZHURNAL VYCHISLITEL'NOY MATEMATIKI I MATEMATICHESKOY FIZIKI in Russian Vol 24, No 4, Apr 84 (manuscript received 20 Mar 82, revised 7 Dec 82) pp 504-513

GAYDUK, V. F.

[Abstract] Modifications of the shooting method are proposed based on structuring the procedure so that the requirement that the Cauchy problems be solvable over the entire integration segment [0,t] can be relaxed, in which case the class of boundary value problems that can be solved is expanded. It is shown that a converging shooting process can be constructed by computing shooting trajectories only as long as they are members of a certain set within which the boundary value problem can be solved. A sequential shooting method is described in which the solution of the boundary value problem is sought sequentially in different segments. The stressed state of a highly flexible rod is analyzed as an illustration. Figures 2, references 12: 10 Russian, 2 Western. [328-6900]

UDC 519.7

RECOGNITION BY LOCALIZABLE FUNCTION METHOD

Moscow ZHURNAL VYCHISLITEL'NOY MATEMATIKI I MATEMATICHESKOY FIZIKI in Russian Vol 24, No 4, Apr 84 (manuscript received 8 Jun 82) pp 587-598

YAKOVLEV, S. A.

[Abstract] The properties of localizable functions are studied within the framework of a nonlinear Neumann-Pearson decision making scheme. Estimates are obtained for the deviation of the decision function of linear recognition algorithms from optimal. A localization theorem is stated and proved. The employment of probabilistic passage to the limit is demonstrated. The concept of a finite-order recognition system is investigated within the framework of the algebraic theory of recognition algorithms. The derivation of inequalities for estimating the recognition error probability is described. References 6 Russian.
[328-6900]

UDC 517.934

SOLUTION OF NONLINEAR PROBLEMS

Moscow ZHURNAL VYCHISLITEL'NOY MATEMATIKI I MATEMATICHESKOY FIZIKI in Russian Vol 24, No 4, Apr 84 (manuscript received 6 May 82; revised 24 Oct 83) pp 612-615

BANDURIN, N. G. and NIKOLAYEV, A. P.

[Abstract] A set method is proposed for solving systems of nonlinear equations for unknown functions depending upon a single parameter in which the increment vector of the sought functions is computed in each step from a system of linear algebraic equations contained by expanding the left part of the original system in a Taylor series and retaining the error vectors. Numerical analysis of large movements of a flexible initially straight cantilevered rod are investigated as an example. References 2 Western.
[328-6900]

UDC 517.977.56

SOME PROBLEMS OF OPTIMIZATION OF QUASIUNIFORM HEATING OF LARGE PARTS

Moscow ZHURNAL VYCHISLITEL'NOY MATEMATIKI I MATEMATICHESKOY FIZIKI in Russian Vol 24, No 5, May 84 (manuscript received 4 Aug 83) pp 686-693

GLASKO, V. B., ZAKHAROV, A. V., IL'IN, M. Ye., POVESHCHENKO, Yu. A. and TIKHONOV, A. N.

[Abstract] Mathematical statements of the problem of defining the control function $\chi(P, T)$ corresponding to different technical approaches are studied. The results of mathematical modeling obtained with the help of regularizing operators are presented. Boundary control problems for distributed-parameter systems described by parabolic equations are examined. An algorithm is formulated for constructing the continuous control function and for finding the heating or cooling time for the heat conductivity equation. References 10 Russian.
[338-6900]

UDC 519.62

SOLUTION ALGORITHM FOR ORDINARY DIFFERENTIAL EQUATIONS FOR CONTROL COMPUTERS

Moscow ZHURNAL VYCHISLITEL'NOY MATEMATIKI I MATEMATICHESKOY FIZIKI in Russian Vol 24, No 5, May 84 (manuscript received 8 Sep 82; revised 14 Mar 83) pp 760-763

PROTOPOPOV, V. A.

[Abstract] A new solution algorithm is constructed for use in control computers to predict processes described by differential equations that speeds up the solution process significantly. The algorithm is based on a sequential approximation method in which the approximations are made for all steps in parallel, rather than sequentially for each integration step. A system of four first-order nonlinear differential equations is solved to illustrate the capabilities of the method.
[338-6900]

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